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COMMUNICATIONS

A CASE OF METASTATIC OSTEOSARCOMA IN THE CHOROID*

BY

V. T. LEES

BLACKPOOL

THE occurrence of metastatic sarcoma in the eye is an event of such rarity, to judge from the few cases reported in ophthalmic literature, as to indicate the publication of a case which came to my attention whilst on active service recently.

To the best of my belief this case is the only recorded instance of an osteosarcoma in the eye.

In 1888 Meigs and de Schweinitz described a case with metastases in the 2nd and 3rd nerves in the cranium, and in the 2nd nerve and in the muscles within the orbit. Both eyes were affected by deposits in the choroid.

The primary growth was a round cell sarcoma in the chest. The spread of metastases was presumed to be from an erosion of the carotid artery found at post-mortem examination.

* Received for publication, May 29, 1947.

A similar case was found by Weiner and described in 1902, and yet another by Ballantyne in 1905, in which the primary sarcoma was in the chest and caused metastases in the suprarenal gland and brain, with deposits in the optic nerve spreading from the disc to the retina.

Heine in 1899 described a metastatic sarcoma confined to the optic papilla.

Schiess Gemuseus and Roth in 1879 attributed a pigmented tumour of the disc to spread from a malignant melanoma of the skin.

In 1907 Neese reported a choroidal tumour derived from sarcoma of the breast, and more recently Elschnig, 1926, reported a tumour of the iris of spindle cell type originating from a primary lesion of the ovary.

The case which I now describe, starting as it did with a sarcoma of the knee, has the characteristic bone cytology so well marked in the ocular deposit as to prove its origin without any doubt.

Another interesting feature in this case was that it was possible to examine the tumour *in vivo* by means of the slit-lamp microscope, though with the magnification available no point of special importance was brought to view by this means.

I saw the patient in May, 1946, at No. 19 General Hospital in the Middle East.

About one year previously the patient injured his knee and developed a sarcoma at the site of injury.

In spite of amputation of the leg, metastases appeared in his chest later in the year.

Two months before consulting me, the patient noticed a vague visual defect in his right eye, which progressed to almost complete loss of vision by the time his eye was examined.

On examination a patch of scleral hyperaemia was present in the lower nasal area.

The anterior chamber was shallow, the pupil dilated and unresponsive to direct light but reacting consensually with the opposite eye. Ocular movement was full and free.

The fundus showed a detachment of the retina present, separable into two parts contrasting in appearance, and caused by a tumour with serous detachments above and below.

The tumour was double, both parts being in the lower nasal quadrant and appearing to be the result of an embolus of tumour cells lodging possibly in a ciliary vessel.

One nodule extended from the disc to about the equator and the other from the equator forwards. In colour they were pink with rounded hemispherical surfaces elevating the retina.

The anterior nodule was clearly seen with the slit-lamp and microscope and appeared to have a loosely fibrillar structure on the surface. No pigmentation was visible.

Transillumination clearly demonstrated the solid nature of the nodules.

Examination showed nothing abnormal in the patient's left eye, nor was any C.N.S. lesion demonstrable.

The patient experienced no pain during the period of observation.

Later the detachment became total and the tumour not visible as a result.

Enucleation was not contemplated as there was no pain to justify such procedure.

Owing to my return home from active service I was unable to follow up the case, but Lt.-Col. J. Anderson, R.A.M.C., kindly obtained post-mortem sections of the eye for me.

These have been examined by Prof. Baker of Manchester University Pathology Department who reports:

"The sections show an osteo-sarcoma forming irregular trabeculae of osteoid tissue. The centres of a few of these trabeculae show calcification, but the bulk of the tissue is non-calcified. The tumour cells show rounded or oval nuclei, and there are some irregular larger types showing the cytology of malignancy. The tumour is a sarcoma of bone origin."

We have therefore in this case an indisputable chain of evidence to prove the diagnosis.

It commences with a known source of bone sarcoma in the patient's knee, which spreads to the mediastinum, and from the

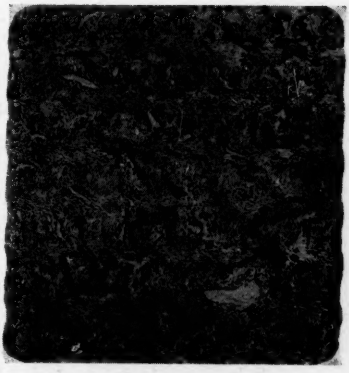

FIG. 1. ×20

mediastinum to the eye, probably by vessel erosion such as was found by Meigs and de Schweinitz in their case of metastatic intra-ocular sarcoma.

The occurrence of a double tumour in the eye indicates firmly that this growth is of metastatic origin, and pathological examination of sections of the ocular deposits shows such a distinctive cell pattern, that from this alone it is possible to diagnose bone sarcoma without reference to the previous history.

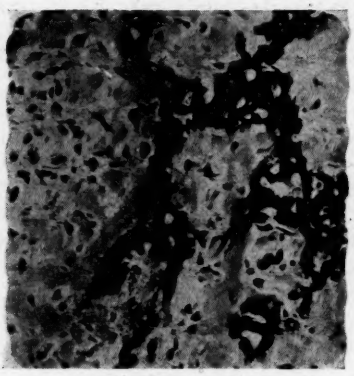

FIG. 2. ×200

Reproductions of photomicrographs of the ocular tumour are published herewith, and show the trabeculae of osteoid tissue with the tumour cells in the interstices.

The dense black areas represent the calcified portions of the tumour.

The sections were stained with haematoxylin and eosin.

I wish to thank Professor Baker for his kindness in examining and reporting upon the tumour sections and for supplying the photomicrographs. I also desire to express my appreciation to Lt.-Col. J. Anderson, R.A.M.C., for his invaluable help in securing the sections of the tumour and forwarding these to me from the Middle East.

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THE EFFECTS OF NITROGEN MUSTARD ON THE PERMEABILITY OF THE BLOOD-AQUEOUS HUMOUR BARRIER TO EVANS BLUE

An instance of the influence of a lesion in one eye on the susceptibility of the other*

BY

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PORTON AND LONDON

THE chemical warfare agent, "nitrogen mustard" or methyl bis (*β*-chloroethyl) amine, has come to the notice of the clinician lately on account of its beneficial effect upon Hodgkin's disease, the leucaemias and some neoplasms (*Gilman and Philips, 1946*). It is also of interest to those studying the problems associated with the changes in the permeability in the blood-aqueous humour barrier since exposure of the eye to nitrogen mustard either in the liquid or vapour form results in a well marked iridocyclitic type of lesion which, in severe cases, may be associated with iris haemorrhages. Similar effects are obtained by dropping a one per cent. aqueous solution into the eye.

The membranes separating the blood from the aqueous humour show a high degree of selectivity; thus the aqueous humour is almost completely protein-free; sucrose, injected into the blood, appears in the aqueous humour only very slowly, whilst the trisaccharide, raffinose, does not appear in the aqueous humour at all (Weld, Feindel and Davson, 1942). Similarly, a large number of dyes, when injected into the blood stream, do not appear in the aqueous humour. (Halpert, German and Hopper, 1933, *Amer. Jl. Physiol.*, Vol. CIII, p. 351). It was considered possible that the damage in the uveal tract caused by nitrogen mustard would manifest itself in the form of an increased permeability of the membranes separating the aqueous humour from the blood stream. If this were indeed the case, then it might be expected that a dye which, when injected into the blood of the normal animal, failed to appear in the aqueous humour, would appear in the aqueous humour of an animal whose eyes had been exposed to this chemical agent. Preliminary experiments showed this to be true; thus chlorazole fast pink, when injected into the blood of the normal rabbit, failed to appear in the aqueous humour; however, after exposure of the animal to nitrogen mustard vapour, the aqueous humour was found to be pink, indicating a change in the selective power of the membranes. The dye finally chosen for these experiments was

* From the Chemical Defence Experimental Station, Porton, and the Departments of Physiology, University College and King's College, London.

Evans blue 1024 which has the advantages of being eliminated very slowly indeed from the blood stream, and of giving an intense blue colour at low dilutions.

The work to be described here was undertaken to find out whether the rate of penetration of Evans blue into the eye could be used as an index to the severity of a lesion caused by nitrogen mustard, and to this end the effects of three different preparations of the substance, known to have different toxicities, were compared. The results showed that this was indeed possible; moreover an extremely interesting dependence of the severity of the lesion in one eye on the condition of the other eye became manifest and for this reason that part of the work bearing on this point is being published.

Experimental

Aqueous solutions of nitrogen mustard were used; on dissolution in water the reagent undergoes a series of changes with time, its activity rapidly diminishing and then rising to a constant value. Thus there were three solutions which could be used, namely nitrogen mustard dissolved in ice-cold water and immediately applied to the eye; the same solution kept for 10 minutes at room temperature, in which case the effectivity would be expected to be minimal; and finally the same solution kept for five hours at room temperature. Toxicity studies had indicated that the order of effectiveness would be:—

A	B	C
Ice-cold	5 hours	10-minutes

Rabbits were injected with 1 ml. of a 1 per cent. solution of Evans blue 1024 in isotonic saline per 5 lb. body weight. 60 mg. of the appropriate solution were instilled into the two eyes. Two hours after the instillation, the aqueous humours were removed from both eyes and the concentrations of Evans blue determined colorimetrically. The severity of the lesion was assessed in terms of the dye concentration in accordance with a somewhat arbitrary scale, the maximal possible dye concentration (namely that in the blood) being given the value 100, and lower concentrations values in proportion. If we wish to compare the lesions produced by the two weaker solutions B and C, we may proceed in two ways:—

(*a*) A standard lesion may be produced in one eye of all animals with solution A; in one group the other eye would have solution B instilled into it, and in the other group the other eye would have solution C. The ratio: Lesion A/Lesion B could be compared with the ratio: Lesion A/Lesion C.

(*b*) Alternatively, in a group of rabbits, solution B could be

instilled into one eye and solution C into the other, and the lesions directly compared.

If the two eyes of an animal can be treated as independent, we may expect to obtain the same results with both procedures.

Results

When procedure (*a*) was used solutions B and C produced lesions of intensities of 17 and of 11 respectively (Table 1), solution B being the stronger as toxicity studies indicated. When procedure (*b*) was adopted, solutions B and C being instilled into the two eyes of the same animal, the lesions were (Table 2) 12 for solution B and 1·6 for solution C, *i.e.*, solution B was certainly stronger in effect than

TABLE I

The lesions produced by three preparations of nitrogen mustard (Solutions A, B and C). In all animals, solution A was instilled into the left eye. The intensity of the Evans blue in the blood was taken as 100 and the values in the aqueous humours recorded below were in proportion and were estimated colorimetrically.

No. of Rabbits	Average Value of Lesion produced		
	L. Eye	R Eye	r = L. Eye/R. Eye
18	(Solution A) 35	(Solution B) 17	2·3
22	(Solution A) 36	(Solution C) 11	3·6

TABLE II

The lesions produced by the two weaker preparations of nitrogen mustard (Solutions B and C). In all animals solution B was instilled into the left eye, solution C into the right.

Method of estimation as referred to in Table 1.

No. of Rabbits	Lesion		
	L. Eye	R. Eye	r = L. Eye/R. Eye
18	(Solution B) 12	(Solution C) 1·6	9

solution C, as indicated in the first series; but with this procedure it appears to be some nine times as effective whereas with procedure (*a*) it appears to be only about one and a half times as effective. The reason for this difference, as the Tables show, is that the weakest preparation, solution C, produces a very small lesion (1·6) when the other eye has solution B in it, whereas it produces a considerably larger one (11) when solution A is in the other eye. Solution B produces a larger lesion when solution A is in the other eye but the effect is not so great, so that the effect of passing from the one procedure to the other is to modify the ratio: Lesion B/Lesion C very considerably.

Now the solution A is the most effective in causing lesions (it causes a lesion of 36 when solution C causes 11, and 35 when solution B causes 17) and the results can best be explained if the instillation of the powerful solution A tends to produce an incipient lesion in the other eye; the effect of the weakest solution (C) will therefore be stronger when solution A is in the other eye than when solution B has been instilled.

Discussion

The two eyes of a rabbit are not necessarily to be viewed as mutually independent organs but rather each as being individually susceptible to changes going on in the other. The reciprocal action is probably reflex in origin, since it is hard to believe that the small quantities of toxic material actually absorbed into the blood from the conjunctival sac could be sufficient to have any general effects by way of the blood stream. The effective barrier which separates the anterior chamber from the blood in the anterior part of the iris is possibly only that due to the endothelial lining of the capillaries, since the endothelium of the iris contains lacunae of sufficient size to prevent it from acting as an intact membrane. It is well known that the permeability of the capillary endothelium to proteins, and therefore to Evans blue, is largely determined by the physiological state of the capillaries; if they are dilated their permeability is high, if contracted, it is low. If the lesion produced by a high concentration of nitrogen mustard in one eye causes a reflex dilatation of the vessels in the iris of the other, then the phenomena described here are explicable on the basis of reflex action. In confirmation of this viewpoint it has been noted that by instilling nitrogen mustard into the left eyes of a group of animals a ciliary injection was observed in the untreated right eyes; only on one occasion, however, was it possible to demonstrate that injected Evans blue appeared in the contra-lateral eye. We may therefore conclude that a severe lesion in one eye potentiates the action of a mild nitrogen-mustard agent in the other by reflex action; in the present case the effects of this

potentiation are greater with the milder solution C than with the stronger solution B.

We are indebted to Sir Stewart Duke-Elder for advice and to the Chief Scientist, the Ministry of Supply, for permission to publish this paper.

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PERIPHERAL AND CENTRAL DISTURBANCES OF THE VISUAL FIELDS. AN ASPECT OF DI-OPHTHALMOLOGY*

BY

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THE cause of eyestrain, concomitant squint, and amblyopia used to be unknown, the diagnosis incorrect, the therapy inadequate and therefore the prognosis dubious. It was not until convergence had been recognized as the kinetic principle of bi-foveal vision[1, 2, 3, 4] that the dynamic factor of human binocular vision was established. From then on the diagnosis, prognosis as well as therapy of these disorders could be shaped on rational lines within the precincts of physiology where they belong. These disorders concern the physiology of the bi-foveal eye, the di-ophthalmos, of which the bi-fovea is the highest achievement.

If each of the three following cases were assessed by the usual standards of ophthalmology, they would have a very sombre prognosis. In these cases, there was no workable diagnosis and therefore no therapy, until they could be recognized as disorders of the di-ophthalmos.

Case I

L., a schoolboy, aged 17 years, was referred to me by his uncle, a specialist-physician, on July 7, 1946 (abbreviated letter):—

> I have referred L. du P. to you. His parents are very concerned as to his condition, and would like to know what the future holds.

* Received for publication, March 25, 1947.

Apparently he has had a limited field of vision all his life. At school, less than a year ago, when the eyes were called upon to do very minute work, he had an attack of blindness followed by severe headache, and then an ophthalmic surgeon discovered the real condition of affairs.

What the parents now are anxious to know is:

(1) What is precisely the nature of his complaint?
(2) What is the prognosis—is total blindness to be expected, and within what period?
(3) Will any treatment help or retard the condition?
(4) Do you advise that he be sent to an Institute for the Blind?

If you think it necessary that a neurologist should also see him, then you are at liberty to make the required arrangements.

L. was brought by his sister because he could not cross the streets by himself. He entered with hands stretched sideways as if feeling for doorposts.

Patient was depressed in his mind. His only desire was not to be examined any more but to go to a school for the blind and learn Braille so as to be able to read and also to learn a trade. He could read printed matter letter by letter only and a page took him "a whole day." From his first school year onwards he saw as though through a funnel, with both eyes together and with each eye separately. The reason why he had never complained—and so his deficiency had not been discovered earlier—was that he knew no better but that such was the case with everybody else. He frequently had headaches, often severe ones, sometimes causing him to faint.

Drawing and reading he could not do without strain and headache nor could he go to film shows. He always became giddy when looking out from a moving train. There was no night-blindness and he could orientate himself well when moving about in his home surroundings, even better at night than in daylight.

He could not play the piano with both hands because he could not see them at the same time. Since his tenth year he noticed limitations of his temporal visual fields. This became worse. When thirteen years of age he had an attack of blindness which lasted about an hour, followed by severe headache for the whole day, and he had to retire to bed. He experienced no nausea or giddiness on that occasion.

Similar attacks occurred on four occasions, the last and worst attack being in March, 1946, during a drawing lesson. He had started seeing spots within the narrow funnel of his vision. He then was sent to an ophthalmic surgeon, and afterwards his uncle

also examined him. The ophthalmic surgeon sent him to a radiologist and to another specialist-physician. After March he left school altogether.

The boy had difficulty in finding the next letter in each row of Snellen's type, but slowly he could distinguish all the letters of the 6/12 row with each eye.

His fields, taken with a white square of 1 cm., were similar in the right and left eye. They did not extend beyond the 11 degree circle and in some meridians only had 9—7 degrees from the centre-point, but in a circle at 25—30 degrees distance from the centre-point, flashes of the moving white square were observed—with each eye.

A neuro-psychopathic disposition was excluded (*vide infra*). Patient was a strong, healthy, intelligent boy. His uncle confirmed this impression and corroborated L.'s story. He further wrote :—

> The ophthalmic surgeon consulted (in March, 1946) gave a very unfavourable prognosis and, I understand, expressed the opinion that L. was soon to go totally blind.
>
> In July (1946) his mother wrote to me that L. was steadily getting worse and that he himself was very worried that he soon would be blind, and that she had arranged for his admission into the Institute for the Blind at Worcester, and that she had received his railway concession to go there.

After this the uncle persuaded the parents to send L. to Johannesburg for consultation.

The report on the X-Ray examination read : The examination revealed no enlargement of the pituitary fossa and there was no evidence of increased intra-cranial pressure. The optic foramina were normal.

The second specialist-physician could find nothing positive, and had written accordingly.

It is evident that ophthalmologically nothing had been neglected in order to arrive at a diagnosis, and also that the ophthalmic surgeon was justified in warning the parents as to the seriousness of the condition, as orthodox ophthalmology could give no clue to the real condition. His prognosis was bad : blindness of both eyes, already far advanced, was increasing and, evidently, total blindness impending.

The psychiatrist to whom L. had been referred by me, wrote :—

"I can find nothing that can throw light on the cause of his condition. There is no question of any organic lesion or neurological deviation. Psychologically this patient is perhaps a little tense, but I cannot find any neurotic or psychotic symptoms, and there decidedly is no sign of any inclination to hysteria. I have therefore a perfectly negative report to render.

I should be pleased to hear the further progress of this interesting case."

In view of the extraordinary features of the case and especially because of the bad prognosis, I asked the opinion of two other ophthalmologists. I showed the letter of introduction by L.'s uncle, the specialist-physician. I refrained from telling them my diagnosis and also that treatment had already been instituted on the strength of that diagnosis. This may explain the slight difference in their and my assessment of visual fields and acuity. He was already more self-confident, as can be seen in the report by one of the two ophthalmic surgeons. It reads as follows:—

Herewith report on L. du P. (July 29, 1946). Examination revealed a normal fundus each side, with visual acuity 6/9 in each eye, with negligible refractive errors. He walked about the place without difficulty, totally unlike a person who had a visual field contraction as is shown on the visual field charts, which I enclose. The visual fields were contracted to 10 degrees (ranging in places to 20 degrees) around the centre-point, with a slight paracentral ring scotoma (relative) within the existing field. Neuro-ophthalmologically I could establish nothing else. Having suspicion that this was a case similar to the case described in your book, I advised him to undergo your treatment.

The other ophthalmic surgeon informed me verbally that he could establish no organic cause for the condition and that it was a case of functional field contraction. His field charts were similar to those of the other doctor and myself. Obviously no adequate diagnosis was made and consequently no rational therapy proposed.

The further progress was that within ten days visual acuity had become normal (6/6) in each eye and that within three weeks after the first, a further report by the one consultant, who had kept in touch with the case, reads:—

Examination on August 13, 1946, showed marked improvement in the fields, there being an almost full field, filled in by relative scotoma extending from the periphery up to the region of 25 degrees on an average.

A fortnight later a third report reads:—

Examination on August 29, 1946. Normal fields with small irregular scotomata about 10 degrees from centre-point, O.D.S.

This is a case of similar type to the one described by you, viz., functional peripheral amblyopia. I am sure this cannot be called a hysterically contracted field, and if so, then you have a very effective treatment to offer. If not, which I think is the case, then you have discovered a new condition and its treatment.

In conservative ophthalmology the prognosis of the case of L.

du P. was bad. Conversely my prognosis was good, because the diagnosis is :—

Functional contraction of the visual field of each eye and diminished central visual acuity (amblyopia), combined with various other symptoms of severe eyestrain, caused by astheno-vergence.

Initially convergence was low, ranging from " negative " convergence : minus 5 prism degrees to (positive) convergence : 6 prism degrees ; a range, therefore of only eleven degrees of prism (instead of ninety degrees of prism, which can be considered as normal range of reflex-convergence).*

In the first ten sittings of kinetic treatment for astheno-vergence it was rather difficult, technically, to go beyond that range upwards (*i.e.*, to increase the " positive " side of the range) because of the contracted field in each eye, as the second image disappeared too readily in the scotomatous area. Treatment was given twice daily for about ten minutes each time.

Progress was rapid. After thirty-eight sittings of kinetic treatment, the range of convergence was from minus 5 to 91, the fields and visual acuity were normal and depression of spirit had made place for energy. In six weeks' time L. could read fluently. That week and the next, by his own choice, he read a complete popular-scientific book (164 pages). He had himself registered for a two months' course of drawing and modelling, and produced good work there.

Three months after he began treatment he was back at school, making up for lost time.

Altogether eighty-seven sittings of kinetic treatment for astheno-vergence had been given during two-and-half months; no other treatment.

Case II

Another case exemplifying a good prognosis in the light of our knowledge of di-ophthalmology is already on record. It has been described by me in 1937, in the monograph, " Eyestrain and Convergence," pp. 38-41. As, however, this description has apparently passed unnoticed, no mention being made of it, critically, in reviews of the book in the medical press, I feel justified in quoting that chapter (abbreviated).

The title is :—

" Eyestrain with Field Contraction."

" Another visual symptom of eyestrain that deserves special

* For definitions and the meaning of some terms in di-ophthalmology, see my monographs " Eyestrain and Convergence," pp. 1-16, and " Squint and Convergence, a Study in Di-ophthalmology," pp. 5-9.

attention is contraction of the visual fields. This disorder in the wake of eyestrain is probably not so rare as our limited experience would seem to suggest. The following case shows that it can assume serious proportions."

In July, 1927, G., a farmer's son, aged twenty-one years, consulted me complaining of frequent headaches and other symptoms of eyestrain of long standing, but his main complaint was some cloudiness in front of his left eye.

Refraction of each eye was normal: a mixed astigmatism of 0·5 dioptre with vertical axis in each eye. Vision of right eye 6/4, of left eye 6/9, with correction (−0·75 D.sph.) 6/4. The fields, as far as a cursory examination revealed, were normal. Ophthalmoscopically or otherwise I could find nothing to account for patient's complaint, except astheno-vergence. Convergence was 12 degrees of prism, negative convergence −5 degrees.

G. could not stay for further observation or for treatment, but I saw him again four years afterwards.

In April, 1931, I was again consulted by G., now twenty-five years of age, a farmer of healthy intelligent appearance. He looked tired and complained that for sixteen months now his left eye gave him the impression of looking through a narrow tube, narrower in full light than in the shade or dark. Since boyhood he had suffered from headaches, occasional giddiness and nausea. He experienced discomfort when reading and had largely abandoned it. Moving pictures irritated him and he had given up going to film shows. He wore tinted glasses, slightly cylindrical. They gave relief against glare but made no difference as to his eyestrain. His right eye saw well.

During the period since his former consultation of me, G. had been regularly attended to ophthalmologically elsewhere. Now his general medical attendant wrote to me that: he complains of headaches and failure of vision. . . . His discs look normal and I find no cause for his failure of vision. . . . Beyond testing the peripheral range of vision and finding that it was very deficient, especially in one eye. . . .

These quotations from his family doctor's letter show that this was not a neglected case, but that it had received apart from the specialist's help the able and careful attention of the local practitioner.

G. was very concerned about the extreme narrowing of the field of his left eye, stating that sometimes at street corners he bumped into people coming from the left. He was afraid of losing the sight of that eye altogether.

Vision of right eye 6/4 (uncorrected), of left eye 6/9 (uncorrected). Glasses made no improvement. It was difficult to find

the next letter in the row with his left eye, the right being covered. Refraction: mixed astigmatism 0·5 with vertical axis for each eye.

Perimetric examination with white object 1 cm. square: *right visual field* showed concentric contraction: in the temporal meridian it was only 75 degrees. *Left visual field* was 5 degrees wide in every direction, measured with white object 1 cm. square in ordinary daylight, on the Bjerrum screen.

Convergence was 12 degrees of prism, negative convergence -5 degrees.

Ophthalmoscopic examination of media and fundus of each eye was negative. An organic cause for the contraction of the visual fields could not be found, and toxic causes not traced in the history. Blinding by snow or other strong light was out of the question. Consequently, it appeared to be a case of *functional* contraction of the visual fields.

There was no evidence in the history or present state of the patient which could point to a psycho-neurotic condition.

In the text-books three conditions only were mentioned as causing functional contraction, viz., hysteria, neurasthenia and traumatic neurosis.

The last-mentioned was excluded, as there was no trauma in the history of G.'s case; moreover, as an independent farmer he was not likely to develop that disorder.

Neurasthenia can be accompanied by *moderate* contraction only, a sign of abnormally quick exhaustion (Oppenheim[5]). Evidently that did not apply to G.'s case of extreme contraction.

Consequently, hysteria only was left for further consideration. The neurologist who, on my request, examined G., reported:—

I was unable to elicit the presence of any symptoms which could be definitely labelled as psycho-neurotic. On examination he presented no abnormal signs except a certain degree of hypo-sensitiveness of the palate and soles. As this condition is present in a large proportion of normal people, I do not think that it assists in the diagnosis.

Hysteria, therefore, could be excluded, the more so as functional contraction of the visual field in a case of hysteria always is a sign of a severe form of the disease. Jelgerma writes in this connection[6] (translated):

"In hysteria various disorders of the visual organ occur rather frequently. They always are evidence of a rather severe form of hysteria. Concentric contraction of the visual field is the best known symptom and diagnostically of the greatest importance . . . so that the patient in some cases has merely left a few degrees round the fovea centralis with conscious perception of visual

impressions. *This form of contraction always is a striking revelation of severe hysteria* . . . Striking features are . . . the lack of symptoms produced. *The patients themselves know nothing of it,* and it cannot be noticed in their daily lives or in their movements and actions."

The contrast of this description with the case of G. is obvious. There could not be a shadow of doubt that G.'s case was not one of hysteria.

I think it necessary to stress this point because to my knowledge the diagnosis of extreme contraction of the visual fields as a sequel of eyestrain has never been made before. I wish, therefore, to make quite clear the complete exclusion of any alternative diagnosis in this case.

The history shows that this was a case of severe eyestrain of long standing. I knew, by my examinations of G. in 1927 and 1931, that he had suffered from uncorrected astheno-vergence for many years. I had measured the convergence and had found it very low on both occasions.

The only course open, therefore, was to treat the case according to the following diagnosis:

Functional contraction of the visual fields of both eyes and diminished central vision of the left eye (amblyopia), combined with various other symptoms of severe eyestrain, caused by astheno-vergence.

The treatment was kinetic.

The ensuing improvement during forty-three daily sittings of kinetic treatment (of ten minutes each) was a model of steadiness. The extremely contracted left field opened up very slowly at first but regularly day by day, until after thirty-six sittings the field was normal. The right eye's field lost its contraction during the same period. Central vision of the left eye increased in acuity, without the help of glasses, from 6/9 to 6/4. Headaches disappeared. G. took to reading again without discomfort. Photophobia was the last symptom to disappear, and G. discarded his dark glasses.

This prompt and complete cure has now lasted more than fifteen years. There never was any recurrence of symptoms.

There are probably many cases of eyestrain connected with functional contraction of the visual fields In the May number, 1930, of the *American Journal of Ophthalmology,* Rowe and Rowland draw attention to the fact that in a general medical service amongst 1,900 patients, 100 were found to have a marked concentric contraction of the visual fields. In half this number the condition could not be attributed to commonly recognized causes. The paper closes with the remark: "There are

apparently many cases of marked field contraction in which the condition has not been detected."

I suggest that in many such cases the cause may be asthenovergence.

Discussion

The two cases of field contraction described in this paper can be considered as extreme cases representative of a large group. My subject, however, is not what they are representative of, but that they are typical forms of field contraction for which there is yet no name and therefore no apparent therapy. In the literature no mention is made of this form of field contraction (except once by me). It probably becomes grouped, unwittingly and wrongly, with other groups of functional field contraction for which there is given an accurate diagnosis, but *the kind of field contraction under consideration here has not yet been recognized as a clinical entity*. Therefore there exists no therapy, and as the condition is progressive diminution of sight, the prognosis must appear bad. This is what the practical ophthalmologist is faced with in cases of this type, unless he realizes its meaning in di-ophthalmology. As soon as the condition is recognized as a bi-foveal matter, showing its main disturbances in the visual field, then the position is clear and therapy rational and effective.

Case III

Another typical case, this time not of peripheral but of central amblyopia, once more emphasizes the importance of di-ophthalmology.

A girl, aged 16 years, had been prescribed −1·0D sph. for each eye. She was studying the piano but was told by the ophthalmologist to give up music and all study, as there was something very wrong with her eyes, which was progressive. The parents were alarmed, and May 30, 1945, came to me for a further opinion.

The history revealed severe headaches during the day-time, and also photophobia. Moving pictures irritated the eyes and caused bad headaches. Often the eyes were bloodshot. Vision, of late years, had become gradually worse. It was thought that the patient had become more and more myopic. She herself, dejected and upset, at first emphatically refused to undergo the proposed kinetic treatment.

I found visual acuity right eye 6/18, with correction (−1·0D. sph.) 6/12, visual acuity left eye 6/18, with correction (−1·0D. sph.) 6/12. Negligible refractive error. Convergence 16 degrees of

prism (principal angle). Negative convergence -5. As this clearly was a case of astheno-vergence causing eyestrain, kinetic treatment was instituted the next day. After twenty-one daily sittings of the treatment (about ten minutes each) the convergence ranged to 91 degrees of prism.

Visual acuity of each eye (without correction) had become 6/5. During the treatment the girl had become bright and lively and resumed her piano lessons. Three months afterwards the visual acuity of each eye was 6/4 (without correction) and her eyes caused no trouble. With my usual precautionary measures, *viz.*, a few sittings of kinetic treatment half a year after the cure and again one or two sittings a year later, the normal condition of the eyes remained stable.

Discussion

This therefore is another case representative of a great group and typical of a kind of condition which is not yet recognized in ophthalmology as a clinical entity, but is known to those who are versed in the facts of di-ophthalmology, which is based on the bi-fovea and its correlate convergence, the kinetic principle of bi-foveal vision.

Summary

These three cases represent a form of disturbance of field or central vision, or both, which if one does not grasp the importance of kinetic factors as revealed by the study of the bi-fovea and its correlate, convergence, must lead to a sombre prognosis. With kinetic treatment, however, which superficially would seem to affect adduction, abduction and bi-foveal fusion only, these cases are effectively cured both of peripheral field limitation and central visual failure. They emphasize the broadness of the conceptions aligned under the title of di-ophthalmology.

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GLAUCOMA SECONDARY TO FIBROCYSTIC DISEASE OF BONE

BY

J. W. E. CORY

BURY ST. EDMUNDS

W.G.W., a farmer aged 58 years, presented himself on December 3, 1946, complaining of loss of vision and discharge from his left eye. He had always suffered from frontal headache on the left side, and recalled as a youth it was often so severe that he had to cool his head on cold metal objects. He had a swelling over the left temporal region, which an old doctor had remarked upon some forty years ago.

On examination there appeared to be some proptosis of the left eye (3—4 mm.) and displacement outwards in the orbit and a bony

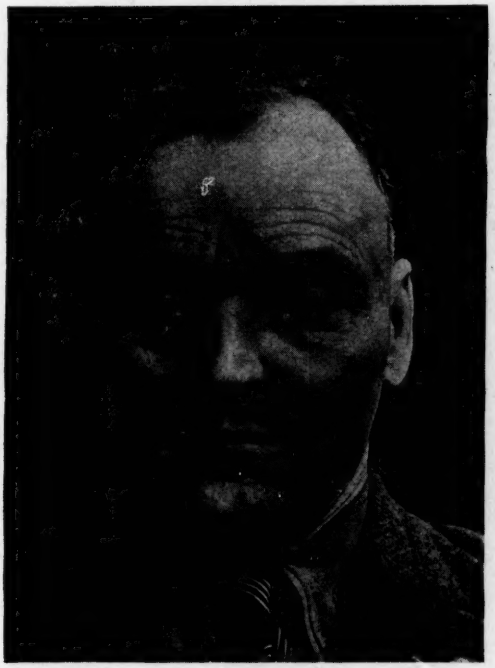


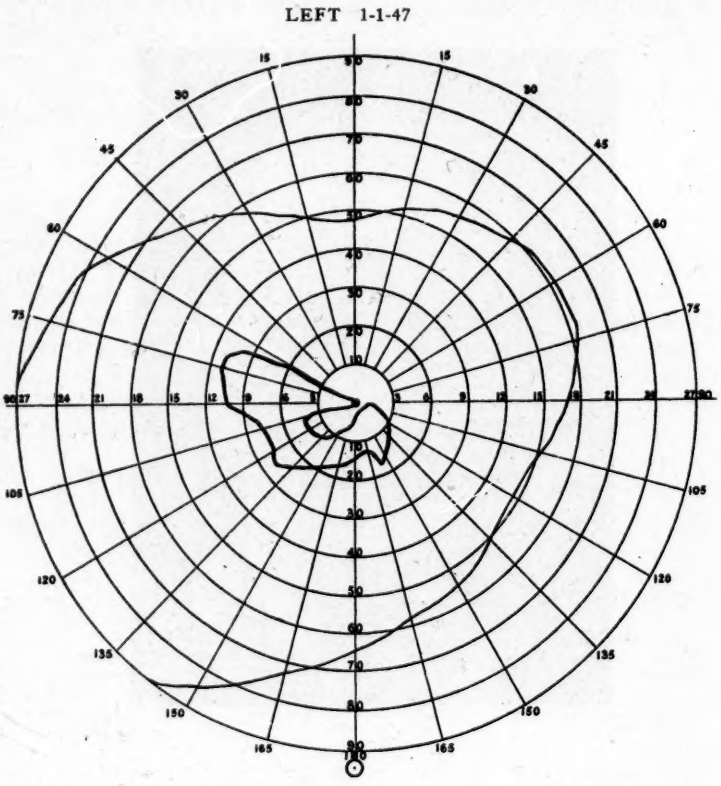
FIG. 1.

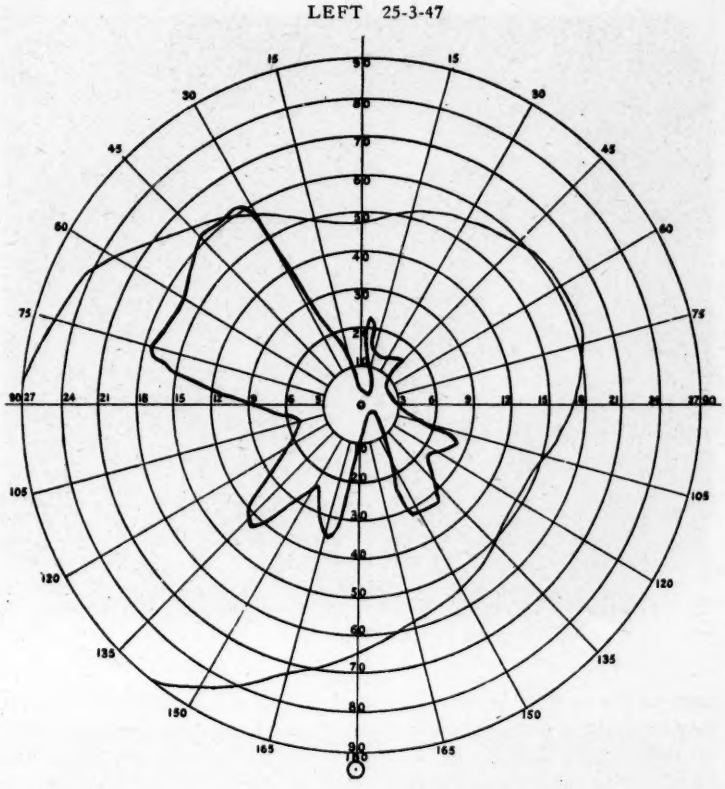
hard prominence of the fronto-temporal region on the left side. The tension of the left eye was raised. R.V. 6/9 with −0·5 cyl. 90° 6/6. L.V. 6/60 not improved by glasses. No discharge was seen and cultures from the eyes were sterile.

Physical examination.—There was a bony hard swelling of the left fronto-temporal region and a hard swelling over the occiput and in the left side of the jaw. The skin was normal and no fibromata were found.

His cardio-vascular system was normal, but blood pressure was 190 mm. Hg systolic and 85 mm. Hg diastolic and there was some fibrosis at the base of the left lung. Urine was normal to clinical tests.

Special investigations.—The tension of the eyes was right 25·75 mm. Hg and the left 33·75 mm. Hg average. (Schiötz tonometer with weights.) Field of vision in the right eye was full and the left restricted to a small field in the upper and outer quadrant.





Ophthalmoscopy.—Right fundus was normal—the left showed a deeply cupped disc of some 6 dioptres and considerable atrophy.

Pathological Investigations.—Urine acid. Specific gravity 1022. Albumen nil. Sugar nil. Acetone nil. Centrifuged deposit nothing abnormal seen. Culture sterile. No Bence Jones proteose present.

Blood Count.—R.B.C. 5,660,000. Haemoglobin 100 per cent. Colour index 0·9. White blood corpuscles 13,400—polymorphonuclear neutrophils 73 per cent. Eosinophils 3 per cent. Lymphocytes 15 per cent. Monocytes 9 per cent. Serum calcium 9·6 mgms. per cent. Inorganic phosphate 5·0 mgms. per cent. Normal 2—3·7 mgms. per cent.

X-ray examinations showed a honeycombed condition of bone in the left frontal, temporal and occipital bones of the skull. The

FIG 2.

sphenoid was fully involved, and although the orbital fissure could be demonstrated on the right side, it could not be so demonstrated on the left side. The frontal and maxillary sinuses were obliterated on the left side although clearly seen on the right side. A complete radiological examination of the skeleton was made and the only other bones affected were the left side of the mandible and the lower third of the right humerus. Oto-rhinological examination by Mr. Ware revealed nothing of added interest.

Operation

On December 17, I performed a corneo-scleral 1·5 mm. trephine operation and his convalescence was uneventful. Subsequent tension readings were within normal limits: average 23·0 mm. Hg (Schiötz).

I think that there is little doubt that the ophthalmic condition was caused by the abnormal bony formation because it was associated with proptosis displacement and increased tension of the left eye.

FIG. 3.

FIG. 4.

FIG. 5.

The bone condition is not a simple one to explain—at first one considered leontiasis ossium, but the fully developed condition is characterised by the leonine appearance which the name suggests and of this he has none. A malignant condition is excluded by the long history borne out by earlier photographs.

An infective condition arising from the frontal sinus in adolescence would be a feasible one, except that the condition rides rough-shod over suture lines and appears in other parts such as the left side of the mandible and the right humerus.

A diagnosis of fibrocystic disease of bone is more probable when the cystic condition of the lower end of the right humerus is examined, but until this was discovered xanthomatosis seemed a likely diagnosis to explain the unilateral involvement of the skull. The full Hans Schüller-Christian syndrome was not present.

I submitted the films to Sir Thomas Fairbank, who discussed them with Dr. Coldwell. Dr. Coldwell is inclined to consider that it is a mixture of xanthoma and fibrocystic disease, but Sir Thomas thinks that the humerus gives the key to the situation and that fibrocystic disease of the bone is the correct diagnosis. He thinks it is atypical and that there is no evidence of parathyroidism.

The ophthalmic condition suggests that the globe is displaced outwards and forwards by pressure within the orbit and that this has prevented the return venous drainage. The tension was undoubtedly raised, but it is a matter of conjecture whether the optic atrophy was the result of glaucomatous rise of tension within the eye or whether it was due to tension on the optic nerve as the result of stretching. It is true that I have been unable to demonstrate a narrowing of the orbital fissure, but the fact that it is demonstrated on the right and cannot be demonstrated on the left suggests that the fibrocystic disease of the sphenoid has so narrowed the fissure that it cannot be seen.

I suggest, therefore, that this is a case of diffuse fibrocystic disease of bone mainly unilateral, which has caused a secondary glaucoma of the left eye and optic atrophy. It is of double interest from the bone and from the ophthalmic viewpoint.

I am indebted to Sir Thomas Fairbank and Dr. Coldwell for their interest and help and to Mr. E. G. Recordon and Mr. H. A. Ware for their valuable suggestions and to Dr. S. D. Kilner for radiological examinations.

THE VARIATIONS IN THE SYSTEM OF THE TRUNKS OF THE POSTERIOR CILIARY ARTERIES*†

BY

T. SUDAKEVITCH

MOSCOW

AN attentive reader will notice the absence in the text-books of ophthalmology of a special section to describe the constant anastomoses of the ophthalmic artery, or, of more importance, the pathological eye-changes connected with them. This fact cannot be explained by the lack of scientific investigation of these anastomoses; they have been well-known for a long time. In 1900, Tichomiroff, Professor of Anatomy, remarked that thanks to Zuckerkandle and Meyer's efforts all the variations of the route and branching of the ophthalmic artery are well known. Also this fact cannot be explained by the insignificant rôle of these anastomoses in the system of the ophthalmic artery and consequently in the life of the eye. Such a supposition is negatived by the anatomical picture itself. It is sufficient to remember that the ophthalmic artery—as was proved a long time ago by prominent anatomists—sometimes starts by two trunks instead of one—the one from art. carot. interna and the other one from art. carot. externa; or only from art. carot. externa. Such a state of affairs is well shown in the illustration of B. Adachi, 1928, A. 1-3.

There is a great difference between a. carot. int. and a. carot. externa; first of all in their architecture and secondly by their relations. That is why the start of the ophthalmic artery only from the art. carot. ext. cannot be compared with its start from the art. carot. interna. This by itself is already sufficient to declare the rôle of the anastomoses to be essential and important for the functions of the eye, and we have to look for a reason why it was so neglected by ophthalmic surgeons.

The reason may be found in the peculiar opinion of the anatomists of the past century *re* the orbital vessels; an opinion inherited by ophthalmology. To show more clearly what I mean, I will quote the opinion of Meyer: " although there are wide limits for the ordinary distribution of arterial branches, nevertheless for the more important and larger ones there is a definite law. All authorities ascribe a certain constancy and independence to the central, lacrymal, supra-orbital and 2 ethmoidal arteries. Because of that they received a localisation—*sui generis*, and they got their

* Translated by N. Pines, London. † Paper read at the meeting of the Ophthalmological Society, Moscow.

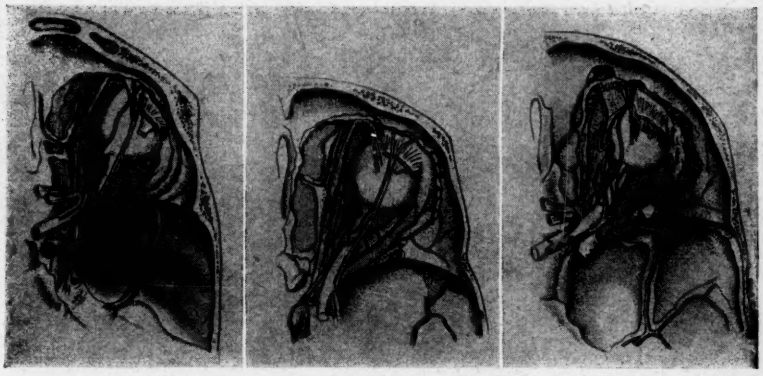


ILLUSTRATION 1. ILLUSTRATION 2. ILLUSTRATION 3.

1. A. Ophthal. starts from a. meningea media (male 28 years of age, right side).

2. A. Ophthal. passes under the nervus opticus. A. lacrym. starts from a. menig. med. (male 38 years of age, right side).

3. A. Ophthal. starts by 2 equal trunks from a. carot. int. and art. carot. ext. through a mening media (male 48 years of age, right side). B. Adachi—" Das Arteriensystem der Japaner "—Kyoto, 1928.

own names. But the muscular and ciliary branches were chiefly considered summarily—jointly to a certain degree" (Tr. Meyer, " Zur Anat. der Orbitalart—Morph. Yahr. Bd. XII, Leipzig, 1887). In those words, as Meyer himself acknowledges, is expressed the general opinion of the anatomists, who reckon as most important only the central art. of the retina, and the ciliary ones only as secondary, described summarily together with the muscular ones. And naturally the question arises, what is then the rôle of the ophthalmic artery in the life of the eye—is it chiefly concentrated in man—especially in man—on the central retinal artery? The physiology of the eye tells us that it is not so. But the authorities who studied the anatomy of the ophthalmic artery and described its system evidently did not follow the principles of physiology. As a result, there is a missing link—the ciliary arteries—and in ophthalmology full use was not made of our previous knowledge of the anastomoses of the ophthal. art. This is why we started to study afresh the system of the ophthalmic artery.

Before describing the results of our own researches we will briefly mention the known forms of variations in the system of ophthalmic artery—the scheme of Prof. Tichomiroff—and adding to it some illustrations (M. A. Tichomiroff, " Variations of the

arteries and veins of the human body," Kiev, 1900) of Meyer and Quain (Quain's Anatomy, 1866, London).

Tichomiroff's scheme of anastomoses of the ophthalmic art. is as follows :—

(*a*) From the trunk of the art. carot. interna are branching off twigs, going to the fissura orbital. ophthal. superior and to the trunk of the n. opticus; here also are coming the twigs from the trunk of the ophthalm. artery, and they anastomose one with the other, and so form a link between the two arteries. A good illustration is the variant described by Meyer (illustration 4, Fig. 7*b*, r.a.c.).

(*b*) The ophthalmic artery supplies twigs to the trunk of the n. opticus, that anastomose with one another, the proximal ones going in the distal direction and *vice versa*. An illustration of this is the same figure 4 (7b, r.a.o.).

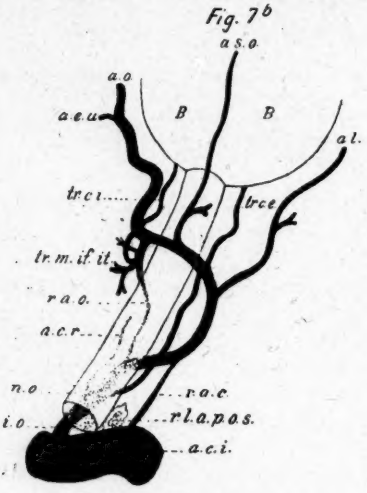


ILLUSTRATION 4.

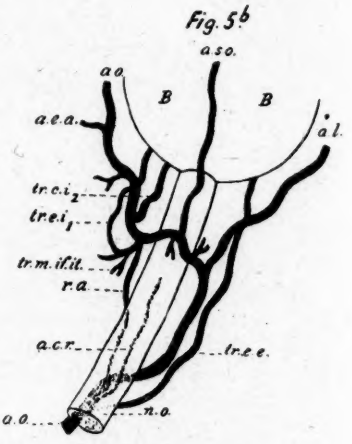


ILLUSTRATION 5.

Illus. 4, Fig. 7b (reconstituted normal route)—r. a. c. an anastomotic branch between ar. cen. int. and art. ophthalmica, passing through fiss. orbit. superior, r. a. o.—an anastomotic twig between the branches of the ophthal. art.—it passes under the n. opticus ; a. c. i.—art. carot. interna ; a. o.—art. ophthal. ; tr. c.e. extern. branch of the art. cil. post. long ; tr. c. i.—the internal branch of the same artery ; a. c. r.—central retinal artery ; a. l.—lacrymal artery ; a. s. o.—supra-orbit. artery.

Illus. 5, Fig. 5b. (reconstituted normal route)—r. a. anastomotic branch between the branches of the ophthal. art. and it passes under the n. opticus ; a. o.—ophthal. art. ; tr. c. e.—an external twig of the art. cil. post. long ; tr. c. i.—the internal twig of the same art., a. c. r.—central retin. artery ; a. l. lacrym. art ; a. s. o.—supra-orbit. art. F. Meyer, " Zur Anat. Der Orbitalarterien."

(*c*) Twigs from the central ret. art. going to the trunk of the n. optic. form an anastomosis with the similar ones from the ar. ciliar. longa posterior. This variant is also described by Meyer (see illustration 5, Fig. 5*b*, r.a.).

(*d*) Anastomosis with the end of the art. maxillans externa (a. angularis) through the nasal branch (ram. nasalis) of the ar. naso. frontalis (ram' art. ophthalmica).

The same variation is represented in the illustrations of Quain, Testut, Vorobjeff; one of them borrowed from Quain is represented here; illustration 6 (IV, 10).

ILLUSTRATION 6.

Illus. 6 (half-schematic ¾) I—ar. carot. interna; II—art. basil.; III—the upper end of ar. carot. ext., III′, III″—arteria maxill. interna; its branches:—1—art. alveol. inferior; 2—ar. mening med; 3, 3—art. masseter. et pterygoidea 4.—ar. buccinat; 5, 5—art. temp. profund; 6—a. alveol. sup.; 7—a. infraorb.; 8—the final branch of art. max. inferior; 9—art. max. ext.; 10—a. angul.; 12—a nasal. later.
Vessels of the orbit 1, a ophthalmica; 2—a. lacrimalis; 3—a. centralis retinae; 4, 4—a.a. ciliares posteriores, 5—a musculares, 6—a. supra-orbitalis; 7, 7—a.a. ethmoidales posterior et anterior; 8, 8′, 8″—a palpebralis; 9—a. frontalis; 10—a. nasal a., which forms an anastomosis with the angular artery (Quain).

(*e*) An anastomosis of the art. tempor. profund ant. with the lacrymal and muscular branches of the ophthal. artery; this anastomosis is made through the orbital twigs of the temporal artery; they go through the fissura orbital inf: and through the temporal canaliculus (see illustration 6, III, 5; 5), Quain.

(*f*) Entering the orbit through the fissura orbital super. the branches of the arter. mening. med. form an anastomosis with the twigs of the lacrymal artery. This variation is demonstrated by the illustrations of Meyer and Adachi (see illustration 7, Fig. 3*b*, r.a.m., Meyer, and illustrations 2, Fig. 63, Adachi).

Here it is worth while to speak about 2 other variations that occur with the participation of the ar. mening. media—we spoke

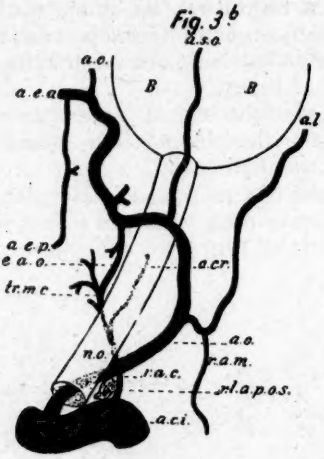


ILLUSTRATION 7.

Illus. 7, (Fig. 3b) (reconstituted normal route) r.a.m. anastomotic branch between the lacrymal art. and art. mening. media, that passes through the fissura orbit. superior, r.a.o.—anastomotic branch between branches of the ophthalmic artery, r.a.c.—anastomotic branch between the a. carot. int. and ophthalmic artery, that passes through fissure orbitalis superior; a.c.i. carotis int.; a.o.—a. ophthalmica; a.l.—a. lacrimalis; a.s.o.—a. supraorbitalis; a.c.a., a.c.p.—aa. ethmoidales anterior et posterior.—F. Meyer.

about them in the beginning of this paper (see illustrations 1 and 3).

(*g*) The orbital branches of the ar. infraorbitalis form an anastomosis with the muscular branches of the ophthalmic artery (see illustration 6, III, 7, Quain). F. Meyer, when describing the various positions of the ophthalmic artery, points out the cases where the artery crosses not above, as usual, but below the optic nerve (also Zuckerkandl, Merkel, Adachi, Taguchi, Javle and others). Merkel's " Macroscopische Anatomie," Graefe-Saemisch, Aufl. I, Bd. 1, T.I. (Cap. 1, 1874), describes vaguely the similarity between the arch of the aorta and some cases of the ophthalmic artery, when its medial part unexpectedly finishes in the posterior ethmoidal artery and so terminates behind the eye instead of going forward, as usual.

When discussing the cause of the above described various positions of the ophthalmic artery, Meyer and others found it in the atrophy or under-development of the main trunk of the opht. art. Meyer even constructed a schematic location of such an atrophy, guided chiefly by variation of the lacrymal and supra-

orbital arteries; he differentiates three positions of the possible localisation of the atrophic main trunk of the ophthalmic artery—*first*, up to the lacry. art. (Fig. *5a*—X; Meyer, illustration 8); *secondly*, between the lacrymal and supra-orbital artery (Fig. *7a*,

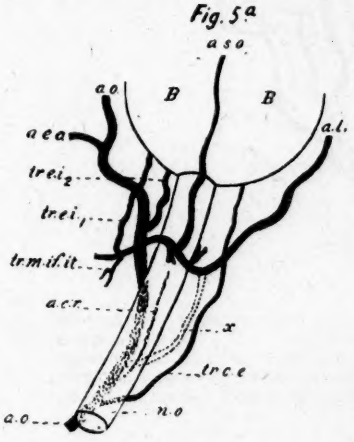


ILLUSTRATION 8.

ILLUSTRATION 9.

Illus. 8 (Fig. 5a) Natural state; x—the part of the trunk of the ophth. art. that disappeared; a.o.—a. ophthalmica; tr. c.e.—the external branch of the a. cil. post. long; tr. c.i.—the internal branch of the same art. a.c.r.—a. centralis retinae; a.l.—a. lacrimalis; a.s.o.—a. supraorbitalis.

Illus. 9 (Fig. 7a) Natural state; x and y —the parts of the trunk of the opht. art. that disappeared a.c.i.—a. carotis interna; a.o.—a. ophthalmica; tr. c.e.—the external branch of ar. cil. post long; tr. c.i.—the internal branch of the same art. a. cil. p.l.; a.c.r.—a. centralis retinae; a.l.—a. lacrimalis; a.s.o.—a. supraorbitalis.

Y; Meyer, illustration 9); *thirdly*, more distal from art. sup. orbit. (Fig. *4a*, X; Meyer, illustration 10).

He reckons, that at the same time—and in the same case—two such atrophic parts may appear, one before and the other one after lacrym. art. (Fig. *7a*, X-Y; illustration 9), and even all three together. (He never saw it himself, but thinks it is possible.)

But Meyer did not explain what is the cause of such an atrophy of the trunk of the ophthal. artery, nor in which period of life does it start; we can only suppose that it happens in the embryonic period, or in the very early post-embryonic period (a very young patient, a female, Meyer).

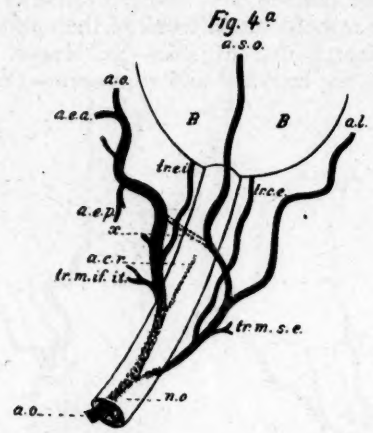


ILLUSTRATION 10.

Illus. 10 (Fig. 4a) Natural state; x—the disappeared part of the trunk of the ophthal. art.; a.o.—a. ophthalmica; tr. c.e.—external branch of the ar. cil. post. long; tr. c.i.—internal branch of the same art, a.c.r.—a. centralis retinae; a.l.—a. lacrimalis; a.s.o.—a. supraorbitalis; tr. m.s.e.—the superior-external muscular branch; tr.m. if. it.—the inferior internal muscular branch.

As far as the connection of the different variations of the branching of the ophthal. artery with this atrophy, Meyer remains the partisan of the old theory and describes the variations of the lacrymal and sup. orbital arteries. The ciliary arteries and even the central retinal artery are left here on the second plane, and are brought forward only when discussing the question of the first branch of the ophthalmic artery.

And so all the researches of Meyer—very valuable indeed—show some detachment of anatomy from physiology and without answering the question (I will speak about that further on), make all the anatomical progress in this direction fruitless. So it happened with Meyer—so is the position to-day.

After all the previous remarks, we will give a short description of our own anatomical studies, with special attention to the two most essential points—the system of the ophthal. artery in the orbit itself and its part within the skull. The ophthalmic artery forms an angle when it goes round the optic nerve before it enters the foramen opticum; first below it and externally, then to the superior external margin and then it turns towards the medial side and crosses the optic nerve from above.

This angle exists nearly always. As a rarity it may be absent, for instance, if the ophthalmic artery is situated below and to the medial side of the optic nerve. The angle is not always the same, not only in different persons, but even in the same person. In childhood and adolescence the angle is always a sharp one. After 24 years of age, it is chiefly perpendicular, and after 40 years it is an obtuse one. The sharp angle may be preserved, in single

ILLUSTRATION 11.

Illus. 11 (magnified) right eye view from above optic nerve. A—ophthalmic artery; 3—a lacrymal artery, branching off on the site of formation of the first angle of the ophthal. artery, 4—lateral branch of the art. cil. post. long; 5—the superior external muscular branch and a twig; 6—ar. cil. p. brevis (Male, 4½ years old).

instances, up to senility, but we do not see it any more after 65 years of age.

We think that nobody up till now has described this angle, but the variations of this angle that are due to age change the correlation between different parts of the ophthalmic artery and so the direction of the pulse-wave, because the artery in this particular spot is always firmly fixed to the membranes of the optic nerve and cannot straighten its angle every time in connection with the pulse-wave. It is because of this that the angle changes with age from a sharp to an obtuse one.

This is the result of two constant but opposed factors—one force working in the distal, the other in the proximal direction. If we imagine that these two forces are acting along the axis of the artery, then the vessel will gradually become longer, forming

bends, and these bends will be evident at every arrival of the pulse-wave; Hyrtle already pointed it out—J. Hyrtle, "Handbuch der Anat. der Menschen," 1879. (This locomotive pulse is a physiological phenomenon of the central ret. artery, described by the Translator and others—Translator's remarks.) As an instance, we can point to our fixed preparations and illustrations of the trunks of the posterior long ciliary arteries (illustration 13 and others); we were able to fix the bends of these arteries by injecting them with ether-cellaodine (red praecip. mercury). But if we find as a primary phenomenon an angle of the ophthalmic artery and, moreover, if it is situated in a most fixed part of the vessel, then we can explain it only by a lateral action of a force usually directed from forward backwards. This force may come only from the branches of the ophthal. artery, situated distal to the described angle. These could hardly be the muscular twigs, because they are usually of equal force and are directed in mutually opposed direction. Therefore they could be only the sup. orb. art. and the posterior ciliary arteries, and probably chiefly the medial branch of the latter. To clear these points, I will cite instances. But before that we have to notice the following: the posterior long ciliary arteries and the central retinal artery usually arise together in the first part of the ophthalmic artery. The first to arise is the medial branch, forming a common trunk with central retinal artery; the

ILLUSTRATION 12.

Illus. 12. The same right eye as in the illus. 11. View from below; 1 medial branch of the art. cil. post. long.; forming a common trunk with (2) central ret. art. 3—a; art. lacrymal; 4—(lateral branch of the ar. cil post. longa.).

second is the lateral branch and in the angle itself is the third branch, the lacrymal artery (see illustration 12). Consequently the long post. ciliary arteries and the central retinal artery receive their blood supply by the shortest way, nearly a direct line. It is really rare to see, in variation, a different way of branching, and in these cases the medial branch is located in the second part of the

ILLUSTRATION 13.

Illus. 13 (magnified) right eye. View from above A—ophthalm. art.; its proximal part is located in the bony canal that is preserved here, forming an obtuse angle. All the ciliary arteries (except the central ret. artery which branches off in the lateral (first) part of the ophthalmic artery—it is covered from above by the optic nerve)—branch off in the second part of the ophthal. art. (distal to the first angle). 3—lacrym. art.; 4—lateral branch of the art. cil. post. long; 5—muscular branch with branching off it; 6 a. cil. post. brevis; 7—a muscular branch, arising from it; 8 ar. cil. p. brevis; 9—the point of division of the trunk of the ophthal. art., which forms two lateral branches, going to the medial wall of the orbit—the posterior one going by the usual route of the art. ethmoid. posterior; 10—medial branch of the ar. cil. post. lon. (Male, 65 years of age).

ophthal. artery, and sometimes it is followed there by the central retinal artery. In these cases we can watch the lateral action of the force, as shown by an earlier and more pronounced increase of the angle, gradually changing from a sharp to a perpendicular one, and from a perpendicular into an obtuse one (see illustration 13). Here the medial branch and the rest of the ciliary artery do not receive their blood supply by the shortest way—nearly a direct

line. The blood-wave first goes sharply round, sometimes even with a reverse direction of the flow of blood, and only after that it reaches the medial branch. As a result, the correlation of forces is upset, the trunk of the ophthal. art. is inclined more and more towards the side of the weaker force, and by so doing increases the angle of deflection of the pulse-wave. And so is built the picture illustrated by us. The picture of the obtuse-angle bend of the ophthalmic artery in the extreme degree, as seen in illustration 13 was not seen by us in ordinary circumstances, even in cases of advanced senility (see illustration 12).

This underlines how important is a definite order of branching of the post. long. cil. arteries for sustaining a favourable correlation in the system of the ophthal. artery from the haemodynamic point of view.

In cases of interruption in the trunk of the ophthal. art. (X) before the point of branching of the lacrym. art. (a. 1)—and that can be seen even in illustrations of Meyer (illustrations 7-9), the medial branch of the long. post. cil. art. (tr. c.i.) is not seen between the first branches—in one case it is not shown (Fig. 4*a*) and in two other cases (Figs. 5*a* and 7*a*) it is shown arising from the medial part of the ophthal. art.

Our researches in 14 cases out of 103 did show that in those 14 cases the ophthal. art. crossed below the opt. nerve; in embryonic or early post-embryonic stage there ought to be a defect up to the first angle of the ophthal. artery, but, as a rule, we saw a variation in the usual order of branching, and the medial branch of the long post. cil. art. was found in the second part, after the lacrymal artery (see illustration 24). Therefore we are entitled to two conclusions.

The first being that we can judge about the interruptions (defects) of the ophthal. artery not only according to variations in the origin of the main trunk of the lacrymal and sup. orb arteries (pointed out already by Meyer), but also on the basis of variations in the rise of the long post. cil. arteries and of the central retinal artery (see our cases, illustration 24), if those defects happened in the part between the foramen opticum and first angle (*i.e.*, before the branching of the lacrym. artery), *i.e.*, where those arteries are usually branching off. The second conclusion is that the unusual rise of the long. post. cil. art. and of the central ret. artery with their appearance on the 2nd part, distal to the first angle, is an unfavourable factor from the haemodynamic point of view. We can easily prove the second conclusion, as nature itself supplies the facts, by providing in those cases anastomoses and accessory branches.

Some time ago Quain affirmed that the posterior ciliary arteries

do not form anastomoses. If he is right—then it is only in ordinary circumstances. But with variations—it is obvious already from the schemes of Meyer and Tichomiroff—this order is interrupted by nature herself—the posterior ciliary arteries do take part in the anastomoses of the ophthal. artery and form anastomoses themselves as well. Because of these anastomoses a circuitous canal is

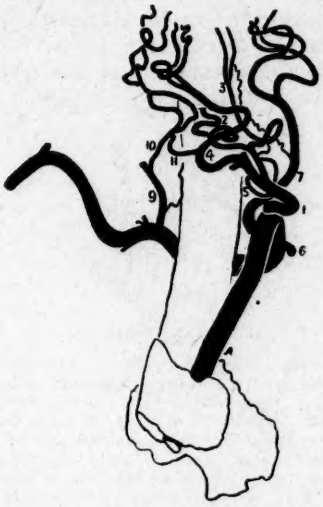


ILLUSTRATION 14.

Illus. 14. Magnified, left eye. View from below. A—ophthal. art, with its proximal part concealed in the bony tunnel preserved here; it forms an obtuse angle, similar to Illus. 13. All the ciliary arteries and the central retinal artery arise from the second part of the ophthal. artery (—distal to the first angle). 1. A powerful lateral branch that supplies 2 ar. cent. retin. and (3—5) 3 post. cil. arteries. 7—a lateral branch of ar. cil. post. long; 6 and 9—lateral branches, the last one supplying (10) a. post. long. cil. arteries; 11—powerful anastomosis between the long. post. ciliar. arteries (between 4 and 10), forming a vascular ring round the optic nerve. The ophthal. art. does not go forward, as usual, but follows the route of the ar. ethm. post. (Male 65 years.)

formed, joining the first and second parts, bypassing the angle; and the blood-wave through this canal finds a new collateral way towards the posterior ciliary and neighbouring arteries. This is the same closed vascular ring round the optic nerve that was described by B. Sokoloff (B. Sokoloff, " Ciliary arteries in man," Perm., 1939), as the starting point of the ciliary arteries and was named by him " circulus arteriosus ciliaris periopticalis." The beginning of such a ring we saw already in the first year of life,

and in this case, the medial branch of the long post. ciliary arteries was situated in the second part of the ophthalmic artery (see illustration 15, 10—A.H.; 8)—medial branch of the long post. cil. arter.

The second factor that we see with such variations—also a compensatory one—is a considerable increase in the number of the short post. cil. arteries; here we see not the usual two, but 3-4 and even 5 branches—and they are located not only in the second, but also in the third part.

Another fact is worth mentioning. The resistance against the blood-wave that we have already described as a force acting

ILLUSTRATION 15.

Illus. 15. Left eye. View from below. A—ophthal. art. whose anterior part. (medial branch of the second part) is divided into two (11) non-equal branches; the posterior—the more powerful one— the real prolongation of the trunk of the oph. art. follows the route of the a. ethmoid. post; 1—lateral branch of muscular type supplies a. (2) cent. retinae, and (3 and 4) short ciliar-arteries; 5 lateral branch of the long. post. cil. art.; 6—lateral branch of the type of lacrymal artery; 8—medial branch of the long post. cil. art.; 9—lateral branch of muscular type forms an anastomosis (X) between its branches and another anastomosis (10) joining it with a lateral branch of the first part (I) In such a way a vascular ring is formed, that will supply a collateral route for the first and second part of the ophthal. artery by developing the anastomoses. (A boy of 4½ months).

proximally and at an angle on the trunk of the ophthal. artery, is helped by another force, acting proximally along its route. This happens in cases of the so-called diffused form—of the ophthalmic artery, *i.e.*, when the medial part of its second part looks like being interrupted and forms 2-3 lateral branches that leave the trunk under an angle (illustrations 19 and 20). The force of resistance, starting here (x) works in the reverse direction vis-à-vis to the blood stream, and shows itself in the initial part of the ophthalmic artery, inside the skull. We are now going to analyse it. (x) By its location this part seems to correspond to the third distal cut in the ophthal. art. that was described by Meyer (Fig. 4*a*, X, illustration 10). We think that with this location of the cut in the ophthal. art. is connected the change of its course from anterior to medial-posterior, that was mentioned by Merkel; we saw it in 5 out of 103 cases (illustrations 19 and 20).

Here in the cavity of the skull, in the narrow space between the entrance of the optic canal and medial to processus clinoideus anterior are meeting together—the internal carotid artery, the first part of the ophthal art., the optic nerve and the edges of the intra-cranial opening of the optic canal. Their correlation may be varied not only in different personalities, but in the same person at differing ages. I allow myself to visualise this meeting point as a triangular figure with equal sides and the base to the front. Its upper part belongs to the optic nerve, its lower one to the upper part of the bend of the internal carotid, the base—to a surface tangential to the bony edge of the intra-cranial opening of the optic

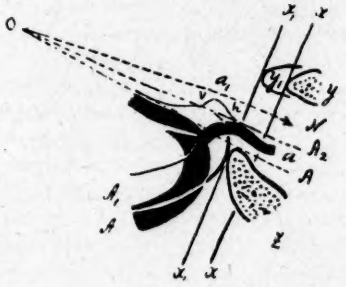


ILLUSTRATION 16.

Illus. 16. A., a—silhouette of the inter. carot. art. and ophthal. artery in a child; A, a—the same in grown-up persons; y, y—the upper bony edge of the intra-cranial opening of the optic canal; z—its lower bony edge; x, x—lines of the surfaces tangential to the upper and lower edges of the opening of the canal—the surface tangent to the upper bony edge is the base of the triangle; ON—the upper side, OA—the lower side of the triangular in childhood, ON and OA_2 in adults; V—the short knee and X—the long knee of the first part of the ophthal. art. in adults.

canal. The ophthalmic artery is located inside of this triangle, between its sides and nearer to the base (see illustration 16).

In the beginning the base of this triangle is relatively large. The point of branching off for the ophthal. art. from the internal carotid and the anterior edge of the arc of carotid, are nearly tangential to the same vertical surface. The angle of the ophthal. art. branching, that is always larger than 90 deg., looks like a crossing of two arcs—ophthal. and inner carot. arteries. This picture we saw in a mature embryo and in children up to 4 years of age. (Illustration 16, A. a.)

In adults the picture is different. The base of the triangle with age becomes smaller. The lower side (OA_2) gradually disappears,

i.e., the arc of the inter. carotid is gradually and actively straightening upwards and partly forwards. As a result, the sides of the triangle come nearer, and the space occupied by the first part of the ophthalmic artery is limited. Hence follow all variations in the correlation between the blood-vessels, optic nerve and the supporting tissue. The arc of the internal carotid artery (A) takes the form of an angle. The first part of the ophthal. artery (*a*) recedes 2-3 mm. backwards from the vertical line tangential to the anterior edge of the arc of the intern. carot. art.

The first part of the ophthal. art. is seen already not as an arc, but as broken-line like ⌐ the shorter knee ∨ the real start of the ophthal. art.—2 mm. long-nearly preserves the previous relation to the arc of the carot. interna, but this part is perpendicular now to the optic nerve, because the arc itself changed its place; the longer knee—h—passes tangential to the lower edge of the optic nerve.

If we seize the optic nerve with forceps, we can displace it to one side and so approach the initial part of the ophthal. art., or if we press on the arc of the inter. carot. from below, then the optic nerve will be lifted up—we have no obstruction here.

But such a correlation is possible and exists only with a definite structure of the intra-cranial opening of the optic canal, when the edges of both bony prominences are not tangential to one vertical surface (illustration 17, XX; X, X); just the opposite, the upper one—Y—is moved forwards, the lower one—Z—backwards, so that the arc of the inter. carotid is tangential by its edge to the surface of the lower prominence (Z, X, X) and does not reach the surface tangent to the upper one (Y, XX). The ophthal. art. branches off the internal carotid 3·6 mm. backwards from the edge of the upper bony prominence—Y. So we saw it in 9 out of every 10 cases. But in every 10th case, we saw a different correlation. The edges of both prominences are tangential to the same vertical surface (Y, Z, X, X), so that the arc of the internal carotid is tangential by its anterior edge to the lower prominence and to the surface tangent to the upper prominence. The ophthal. art. branches off the carot. int. under the upper bony prominence Y, and the latter forms for it a bony roof.

If in such a case we try to displace with forceps the optic nerve to reach the initial part of the ophthal. art., we will not succeed—the bone that hangs over the artery will be in the way, and also if we press from below on the arc of the internal carotid art.—our pressure will be transmitted to the optic nerve, but the latter will not rise over the artery—the same bone will not allow it—as it will be only pressed against the bone. This initial part of the ophthal. art. in such case will be squeezed in the narrow space

between the sides of the triangle; *i.e.*, between the opt. nerve and the upper knee of the arc of the internal carotid.

And, in our opinion, such a state is important, not only for the function of the ophthal. art., but even for its existence. This shows itself by the changes in the external architecture of the internal carotid and ophthalmic arteries, and by the changes in their lumen.

Let us study it more closely. Ordinarily the difference in the circumference of the carot. ar. before and after the branching off of the ophthal. art. is 2-3 mm., and does not exceed 4 mm., but in our cases, in 5 out of 10, the difference is 5 and even 8 mm. The increase in this difference is due to the increase in the size of the internal carotid before the branching off of the ophthal. art. Because of that the carot. int. may look like an ampoule (in one of our cases).

The opht. art. on the other hand was smaller inside and was only 4-4·3 mm. Externally the art. had additional bends in the first part—it looked lifeless; and the branches—the posterior ciliary arteries—were abundant in angular bends instead of forming arcs (illustrations 17 and 18).

Finally the lumen of the carot. int. showed here an earlier and more intensive agglomeration of sclerotic spots that formed massive layers and sometimes even a whole tube of bony hardness with a tiny opening for the branching off of the ophthal. art. The lumen of the ophthal. art. is narrow, the usual needle of a 2 gramme syringe could not enter it freely, as usual. And sometimes it went so far, that the initial short knee of the ophthal. art. had only the lumen of a capillary. From 10 of our cases, where the ophthal. ar. branched off the carot. int. under this bony roof, in two we found this capillary lumen of the initial part of the ophthal. art. (illustrations 17 and 18).

We can look upon this capillary lumen of the ophthal. art. as an incomplete intracranial cut. Such an instance has already been described by Meyer for the intra-orbital part. But in our opinion, his cases and the cases (especially the consequences) that we saw not only between adults, but even in infants 3-4 months old, are really of embryonic origin.

The same intracranial interruptions of the ophthal. art. that we were the first to see ought to be reckoned according to its genesis, not only post-embryonic but even due to the age, because they appear together with senile arteriosclerosis. The immediate cause of their appearance is obvious from the above described architectural changes under a bony roof. The mechanism of these variations is as follows: The initial short knee of the ophthal. art. —V—as described above, is perpendicular to the optic nerve. Because the systolic-wave, knocking at the upper wall of the artery,

tries to straighten the artery out, but meets the immense obstacle of the bony roof, it loses part of its locomotive energy before it penetrates further into the ophthal. artery. But this lost energy does not disappear without trace—it is transformed qualitatively into a new force—into a pressure, that is transferred back into the arc of the internal carotid, and so increases the intra-arterial pressure of this artery, and this is fairly high in any case. So are created favourable conditions for the local changes, that we have just described.

The capillary lumen, or in other words, an incomplete interruption of the initial part of the ophthal. art., due to age, starves the

ILLUSTRATION 17.

ILLUSTRATION 18.

Illus. 17. Right eye. View from above. The ophthal. art. in its first part has an additional bend; the medial part of the second part (5) is divided into 2 unequal branches, directed towards the medial wall of the orbit, and the more powerful posterior one is really a prolongation of the trunk of the ophthal. art. and follows the route of the post. ethmoid. art. I—a medial branch of the art. cil. post. long. arises, as a first branch by a common trunk with the central retinal art. (covered from above by the optic nerve). 3.—lateral branch of the ar., cil. post. long; 4—a lateral branch with a small twig towards the eye.

Illus. 18. Left eye. View from above. The ophthal. art. with an additional bend in its first part, rather weak in its size and appearance; its medial part, in the second part, in spite of its bend, still preserves the magistral type and its forward direction. The order of branching is similar to illus. 17—the first to arise is the medial branch of the art. cil. post. long. by a common trunk with the central ret. artery (covered from above by the optic nerve in such a way that only the dorsal part of the medial twig is seen (I); 3—lateral branch of the ar. cil. post. long. In both cases the weakness of the branches, multiplicity of their bends formed with an angle instead of the usual arc, and the increase in their length are remarkable (female, 80 years of age).

whole system of its chief source of blood supply, and it ought to cause it to perish. But this is an experiment *sui generis* staged by nature herself, probably not known to Wagenmann when in his experiments he cut across all the posterior ciliary arteries in a rabbit and sometimes produced phthisis bulbi (Martin Bartels—"Blutgefasse des Auges bei Glaukom"—Diss, Berlin, 1905). And this experiment of nature looks even more dangerous than the cutting of the ciliary arteries. But we never saw in such cases a phthisis bulbi, in spite of the fact that we are certain that this capillary lumen existed much earlier than our discovery. How then otherwise can one explain it, if not by collateral blood-supply, formed out of permanent anastomoses of the ophthal. art.? And all depends only on the ability of those anastomoses to replace the interrupted route of the blood-supply.

We judge the sufficiency of the development of the ophthal. art. anastomoses as we did before by the development of the variations of the basic magistral; it would correspond to the law of Krause, mentioned already by Meyer. The law of Krause says, that variations arise because of wrong development of normal anastomoses; and according to this law one would suppose that the anastomoses of the ophthal. art. would be developed better in the case 64 (illustration 17), than in 64a (illustration 18). And the external view of the arteries in both cases follow this law—they look better in the first case than in the second one, where we see relatively less variations in the basic magistral.

And so on the basis of our cases we are convinced of how important in the life of every human being is the definite osseo-vascular correlation, which develops in the narrow intra-cranial space in front of the optic canal.

We established the important part of the bony roof as a direct cause of an interruption of the ophthal. artery at certain ages.

But this is not the only cause of such cuts. We saw such an interruption with the normal osseo-vascular relation in this spot in the case of the so-called diffused form of the ophthal. art. described previously; especially when the medial branch of the second part of the ophthal. artery, in the orbit, looks as if being cut, but really divides into three branches, going in opposite directions to each other, and all of them perpendicular to the main trunk. See illustrations 19 and 20 in the case 68a; it appears that such an architecture creates conditions analogous to those, that (or the sequelae of those) we saw in the initial intracranial part of the ophthal. artery, under the bony roof of the intracranial opening of the optic canal. The mechanism of the action, different in form, is essentially the same. Here, in the case of A. 68a, we met an obstacle of bony consistency that narrowed the lumen of

the initial short knee of the ophthal. art.—V—in its whole length of 2 mm.

There was only a capillary lumen in the centre of this blockage, hardly visible to the naked eye. This so-called " due to age "—incomplete interruption of the ophthal. art. ought to cause the destruction of the whole system. But we did not see it happening.

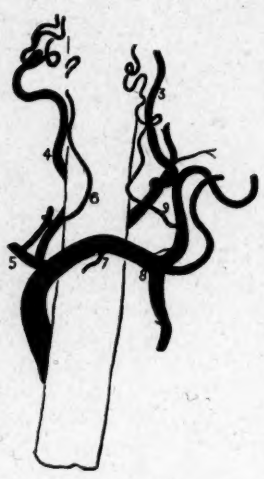


ILLUSTRATION 19.

ILLUSTRATION 20.

Illus. 19 and 20. Left eye. View from above and below. The ophthal. art. goes round the optic nerve by a powerful arc, and medial to the nerve in the second part, suddenly comes to an end (8) and forms 3 lateral branches, that go in different directions with a perpendicular angle. I—powerful muscular branch, from which branch off (2) cent. ret. art., and later a medial twig of the ar. cil. post. long. (3); 4—a lateral branch of the a. cil post. long.; 5—a lateral branch of the type of the lacrymal art., that gives off a lateral branch of 2nd degree with a small twig attached; 6—ar. cil. p. brevis; 7—lateral branch; 8—the point of dividing of the main trunk of the ophthal. art.; 9—a. cil. p. brevis. (Female 45 years of age).

The external architecture of the arteries gives evidence of their good tonus, their good general state. The presence of variations of the ophthal. art., according to Krause's law, points to a good local development of the anastomoses.

If you compare those 3 cases with the " age " interruption of the ophthal. art., then in the latter, we have to acknowledge (68a) —judging by the development of the variations—a better state of anastomoses, than in the other 2, and in those 2 the second one (64a) has the worst anastomoses.

And so, watching the cases of " age " interruptions in the initial

intracranial part of the ophthal. art., we realise the important rôle of the anastomoses of the ophthal. art., and we begin to understand their importance.

Let us return now for a moment to the question of the branching of the ophthal. art. and, following in the footsteps of the previous authors, try to contrast an ordinary scheme of this branching —then as a first branch we have to nominate the medial one of the long post. cil., art., forming a common trunk with the central ret.

ILLUSTRATION 21.

ILLUSTRATION 22.

ILLUSTRATION 23.

Illus. 21. Usual type (48·5 per cent.). Art. cil. posteriores and art. centr. retin. branch off together in the first part of the ophthalm. artery. The first to branch off is the medial twig of the art. cil. post. longa by a common trunk with the ar. cent. retin. The central retinal artery has the magistral type with the usual forward direction and crosses the optic nerve from above.

Illus. 22. Variation. The central ret. art. arises first, as the first branch (19·3 per cent.); the long post. cil. art. arise separately, and their medial branch is located in the second part of the ophthal. artery.

Illus. 23. Variation. The lacrym. art. arises first (13·3 per cent.); all the others—the cent. ret. art., and the long post. cil., ar. branch off it.

art., instead of the central ret. art. according to Meyer, or lacrymal artery according to Testut.

It does not mean, of course, that other branches cannot be the first ones. If we try, guided in each case by the first branch, to divide all our cases in groups, we will have 4 groups. The most numerous one will be the group with the medial one, as the first branch (50 out of 103 or 48·5 per cent.). Then follow 3 weaker groups, nearly equal to one another—2nd with central retinal artery, as the first branch (20 out of 103—19·3 per cent.); third with a lateral branch (19 out of 103—18·4 per cent.) and the fourth one—with the lacrymal artery (14 out of 103 or 13·5 per cent). For illustration we include a scheme of 7 illustrations (21-27).

In the first 4 we see variations of branching (in one of the illustrations showing the lateral branch, as the first, one can also see the usual in such cases variation in the position of the ophthal. art.—going below, and not above the optic nerve—usually in one eye only in all our cases). The remainder of the 3 illustrations show the variations of the position of the ophthal. art. going across the optic nerve medially and from below, interruption of the medial

ILLUSTRATION 24.

Illus. 24. Variation. The lateral branch of the long post. cil. art. comes off first (18·4 per cent.); the central ret. art., and the rest of the long post. cil. arteries arise separately and in different parts of the ophthal. art. The ophthal. art. has a magistral type; goes forward as usual, but crosses the optic nerve from below instead of above (13·5 per cent.).

part of the ophthal. art. with an incomplete forward direction—and in the last one, a complete change of direction from a forward one to a posterior medial one and the main trunk of the ophthal. art. going the way of the post. ethmoid art.

A scheme of variations in the location and branching of the ophthal. art., according to our researches is shewn in 103 cases, illustrations 21-27, I-YII.

The basic magistral of the ophthal. art. is marked by the letter A; its branches—by numbers, the same as in all illustrations, 1—a cent. ret. art., 2—medial branch of the ar. cil. post. long; 3—lateral branch of the a. cil. post. lon.; 4—lacrym. art.; 5—sup. orbit. art.; 6-7—muscul. art.; 8—post. ethm. art.; 9—anter. ethmoid art.; 10—the point of division of the basic magistral. Right eye, view from above.

The last variations make the human ophthal. ar. similar to that of the animals, where we always saw the art. end behind the bulb and dividing into two powerful branches—post. cil. art. (see illus. 28)—the result in 50 cases of pigs' and cows' eyes.

ILLUSTRATION 25.

ILLUSTRATION 26.

ILLUSTRATION 27.

Illus. 25. Variation. (6·79 per cent.); the ophthal. art. lost the magistral type; the medial part of its second part is divided into 2-3 lateral branches, out of which the weakest goes forward, as would the magistral, and the more powerful one goes directly to the medial wall of the orbit, following the route of the posterior ethmoid. art.

Illus. 26. Variation (4·8 per cent.); the ophthal. art. lost the forward direction, goes to the medial wall of the orbit, follows the route of the posterior ethm. art. (may divide itself or not).

Illus. 27. Variation (0·97 per cent.); the ophthal. art. passes under the optic nerve in the same direction, as illus. 26.

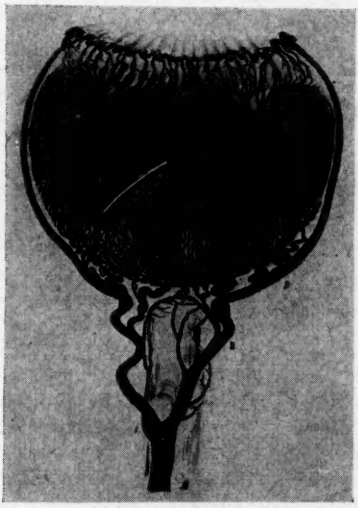


ILLUSTRATION 28.

Illus. 28. Schematic design of the ophthal. art. of the cow and pig. A—ophthal. art.; it gives at first a twig to the optic nerve (I) art. cil. brevis, and later divides in 2 branches—(2) post. long. cil. arteries. and they give twigs to the choroidea—art. cil. post. brevis (3)—in the net of the choroidal vessels two vortices are visible.

And so, coming back to our question, we have to acknowledge that the first branch most frequently is the medial one of the post. long cil. art. with a common trunk with the centr. ret. art. But it will not be the "norm" that was looked for so unsuccessfully by Meyer, it will be only the usual and more frequent order of branching, purposeful as far as all the long post. cil. art. - arise together in the first part (up to the first angle), and this gives them a great privilege from the haemo-dynamic point of view. But this purposefulness is only relative and may be changed in the reverse position, when the correlation with other tissues (for inst. the supporting one) will be changed, as we saw in our 2 variations with the "age" interruptions of the ophthal. art. (illustrations 17 and 18, cases 64 and 64a).

Here, in both cases, the first branch was the medial one of the long post. cil. art. by a common trunk with the cent. ret. art.; it looks like a "norm," but both of them, although in a different degree, proved to be unsatisfactory with appearance of the interruption due to age, because both of them probably possessed only weak anastomoses. At the same time, the third case of the same group (illustrations 19 and 20, case 68a) had at first quite an extraordinary one—a muscular artery, that even did not enter into our scheme—and it was quite successful in dealing with such an interruption, because in passing through embryonic variations it was provided with good anastomoses and they were brought into action, when needed.

TRANSPLANTATION OF VITREOUS*†

A Preliminary Report

BY

HERBERT M. KATZIN AND JOHN BLUM

NEW YORK

Introduction

THIS study was stimulated by the recent work that has been done on the transplantation of vitreous particularly by Cutler[1]. Many attempts have been made in the past to remove vitreous without replacement or to replace it with saline solution, air, or animal vitreous. With the advent of the Eye Bank, and the availability of fresh human vitreous, we determined to conduct further studies. The

* Under the auspices of the Eye-Bank for Sight Restoration, Inc. Director of Research, Herbert M. Katzin. Visiting Research Fellow, John Blum, Adjunct Physician to the University Eye Clinic of Geneva (Switzerland).

† Received for publication, August 13, 1947.

present report is of a preliminary nature and we expect to amplify the studies with human material at a later date.

Literature

We shall not attempt to make an exhaustive survey of the literature as this will be published elsewhere with the clinical paper that is being prepared on the subject (Fritz[2]).

In 1890, Ford[3], reported on the Proposed Surgical Treatment of Opaque Vitreous. He withdrew from ten to eighteen minims of vitreous through a needle inserted above or below the external rectus muscle. The procedure was repeated in three or four days and vitreous was withdrawn as many as four times. The amount withdrawn depended upon the consistency of the eyeball. Ford assumed that clear vitreous was resecreted.

In 1893, Deutschmann[4], reported a few good results from the injection of animal vitreous into human eyes for the treatment of retinal detachment.

In 1911, Elschnig[5], extracted vitreous and replaced it with saline as a method of replacing pathological vitreous.

In 1912, Rosentstein[6], carried out forty-two vitreous aspirations on twelve patients who had traumatic vitreous opacities, disseminated choroiditis and iridocyclitis, and he observed no ill effect from the procedure.

In 1912, Komoto[7], "washed out the vitreous" in two cases of eyes that were blind due to vitreous haemorrhage. He made a scleral incision and washed out with a 0·6 per cent. solution of sodium chloride.

In 1921, Erlanger[8], removed 0·5 to 0·7c.c. of vitreous and repeated it in ten days on an eye which had an infected Elliot's trephine. The procedure saved the eye with some vision.

In 1921, Blatt[9], did vitreous aspirations on four patients, removing 0·6 to 0·8 c.c. with satisfactory results. He mentioned as indications, all forms of vitreous haemorrhage due to trauma and uveitis.

In 1922, Blaisch[10], performed three punctures on successive days, removing 0·4 to 0·6 c.c. each time on an eye that had an intra-ocular infection following a perforating injury; the vitreous cleared rapidly and the eye was saved with corrected vision of 6/18.

In 1924, Hamburg[11], reported on fourteen cases of chronic iridocyclitis treated by vitreous punctures and aspiration. He reported good results in approximately 1/5 of his cases.

In 1924, Rochat[12], experienced failures in three cases using vitreous extractions for chronic uveitis.

In 1924, Bleidung[13], reported on sclerotomy without vitreous aspirations in vitreous opacities or bleeding.

In 1925, Zirm[14], did vitreous aspirations on four cases with

vitreous opacities. The result was good in one case, and the other three were doubtful.

In 1927, Bufili[15], presented seven cases of vitreous extraction with good results. They were cases of vitreous haemorrhage, opacities and glaucoma.

In 1928, zur Nedden[16], used aspiration of the vitreous in cases of ectogenous infections, vitreous bleeding, diffuse choroiditis, traumatic and haemorrhagic glaucoma and embolism of the central retinal artery, but he did not replace the aspirated vitreous.

In 1946, Cutler withdrew and replaced vitreous with vitreous from human donor eyes. In two out of three cases in which there was old haemorrhage, the transplant was successful in reducing the opacity.

Methods and Materials

Rabbits were used because of ease of handling and convenience. Thirty-nine eyes were experimented upon and several methods were employed to study the transfer of vitreous.

Group I. In five eyes the vitreous humour was withdrawn without replacement. In these eyes 0·5 to 1·1 c.c. vitreous was withdrawn through a 20 gauge needle at six o'clock, 5 mm. from the limbus.

Group II. In six eyes, the vitreous was withdrawn and saline was injected. In these eyes, 0·7 c.c. vitreous was withdrawn through a 20 gauge needle at six o'clock, 5 mm. from the limbus and replaced with sterile saline by injection through the same needle.

Group III. In four eyes 0·15 to 0·2 c.c. aqueous was withdrawn through a 26 gauge needle which was passed through the limbus and the fluid volume of the eye was restored by the injection of vitreous with a 20 gauge needle through the sclera at six o'clock, 6 mm. from the limbus.

Group IV. Vitreous was withdrawn and replaced in 24 eyes. Three different methods were used:

(*a*) In two eyes fixation sutures were used to draw the eye over and the region at six o'clock 7 mm. from the limbus exposed. A suture was placed in the sclera, and with a 17 gauge needle 0·5 c.c. of vitreous was withdrawn and replaced and the suture tied.

(*b*) In fifteen eyes, 0·7 c.c. to 1·0 c.c. vitreous was withdrawn from a donor eye through a 20 gauge needle and injected into the recipient with a 23 gauge needle through the same hole.

(*c*) In seven eyes, a mattress suture was placed 7 mm. from the limbus in the sclera at 6 o'clock. A 3 mm. incision was made with a Graefe knife between the arms of the suture and from 0·2 to 0·4 c.c. was withdrawn through a 20 gauge needle and injected simultaneously through a 23 gauge needle. The suture was drawn taut and tied as the needle was removed.

Results

Group I. In these five eyes the tension became very soft immediately after withdrawal of vitreous but returned to normal after two to four days. The vitreous became hazy, subsiding during the first week. In three cases, retinal detachment occurred with a hole noted at the site of injection. In two of these, the detached areas subsided within the first month and healed with a small area of fibrous tissue proliferation, forming a retinitis proliferans. In the third case, the detachment was still present on the fourteenth day and the rabbit died on the seventeenth day. Of the four cases that survived, all eventually showed pigmentation reaction around the site of puncture and clear vitreous with normal tension.

Group II. Of these six eyes, one remained clear and five developed vitreous haze. Three of those that developed haze also developed complete retinal detachment which did not subside. The other two cleared. After six months the three eyes which did not develop retinal detachment had completely recovered except for pigmentary reaction around the site of injection.

Group III. In these four eyes, a white, convoluted, fluffy opacity appeared at the site of injection immediately after introduction of new vitreous. The opacities cleared in the course of one week, in three instances, and in the fourth instance, it took four weeks. All the eyes remained with clear vitreous, normal tension and the typical pigmentary reaction around the scar.

Group IV: (*a*). In one of these two eyes, a cataract formed after the operation and the details could not be followed. In the other eye, a haemorrhagic reaction occurred in the region of the incision and cloudiness of the vitreous developed which took two weeks to subside. The vitreous remained clear, thereafter, and there was no detachment, although there was pigmentary reaction around the scar.

(*b*). In these fifteen eyes, vitreous remained clear in two and opacities developed in thirteen. The opacities were marked in ten and mild in three. Of those that were marked, six cleared within a period of two to four weeks; two cleared in a period of two months leaving an area of proliferated fibrous tissue and two did not clear. There were four retinal detachments, of which two healed and two remained detached (the two with persistent dense vitreous haze).

(*c*). In these seven cases, the vitreous was not as easily controlled and a certain amount was lost during the process of injection. In one case, a traumatic cataract formed which prevented visualization of the interior of the eye. In one case detachment occurred which subsided after seven days. Vitreous opacities occurred in all these cases and there was a small amount of haemorrhage near the puncture

Group	Total eyes	Retinal detach. which subsided	Retinal detach. which persisted	Pig. reac. with proliferation	Pig. reac without proliferation	Vit. haze which cleared	Vit. haze which persisted	Cataract
Group I	5	2	1	2	3	5	0	0
Group II	6	0	3	0	3	2	3	0
Group III	4	0	0	0	4	4	0	0
Group IV	24							
(a)	2	0	0	0	1	1	0	1
(b)	15	2	2	5	8	11	2	0
(c)	7	1	0	0	6	6	0	1

site in three. However, all of the eyes healed with clear vitreous and the usual amount of pigmentary reaction around the site of injection.

The follow-up period was six months.

Comments

It will be noted that the transplantation of vitreous is not without its complications. Although retinal detachments in rabbits are prone to heal spontaneously, nevertheless, a significant number occurred that did not subside. Cataracts occurred due to injury by the operator. The lens in the rabbit's eye is quite large and difficult to avoid when a large amount of vitreous is removed. Vitreous haze, we believe, is due to alteration in the physico-chemical properties of the injected vitreous and the uveal reaction around the puncture site was normal wound healing. No case of chronic uveitis was noted.

In the human, the pars planum approach to the vitreous is considerably easier, the lens is smaller, but the human eyes would not be normal eyes when selected for a vitreous transplant.

So far as the structural change in injected vitreous is concerned, there are undoubtedly significant alterations caused by the passage through a narrow needle, but from a clinical point of view, the transplant may still be successful and in our experience, vitreous transplantation is more successful than replacement with saline. The eye of the host may metabolize the injected vitreous and accept it into its own structure.

Summary and Conclusions

Transfer of vitreous was studied experimentally in thirty-nine rabbit's eyes with a follow-up period of six months. Several types of procedure were used which are described in the text and the comparison between these procedures in the experimental animal and in the human have been discussed.

Two traumatic cataracts were produced, six retinal detachments occurred which persisted and a localized fibrous tissue proliferation around the puncture site occurred in seven eyes. These complications, particularly the retinal detachment, are significant and should be borne in mind in the election of vitreous transfer as a clinical procedure.

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AUTOHAEMO-THERAPY IN HORDEOLOSIS*

BY

H. J. STERN

JERUSALEM

AUTOHAEMO-THERAPY seems to fall into oblivion. In this age of sulfonamides and penicillin it is regarded by many as a sort of mediaeval witchcraft. It has been tried and recommended in so many conditions, and the disappointment of bona-fide followers has frequently been so poignant, that it has fallen into discredit even in cases where its action is beneficial beyond doubt.

Autohaemo-therapy has been tried in asthma, serum sickness, urticaria; it has been employed in herpetiform dermatitis and

* Received for publication, July 8, 1947.

pemphigus, in malaria and hemiplegia, and in practically all inflammatory eye conditions including, of course, trachoma and sympathetic ophthalmia. We find enthusiastic reports and thorough disappointment, tepid recommendation or no reference at all in many text-books.

This bewildering state of affairs is due to the fact that autohaemo-therapy has been employed without discrimination in a multitude of conditions, with disappointing results in most of them.

There are some conditions, however, in which autohaemo-therapy is of undeniable value. Its beneficial effect on furunculosis is well known, and the same applies to hordeolosis, but it seems that the great number of alternative therapeutic agents, particularly sulfonamide and penicillin lately, have overshadowed its value and that it is but rarely used nowadays. It might be justified, therefore, to recommend once more this simple and effective therapy which has proved beneficial in so many cases.

A crop of styes, distributed over months sometimes, can be one of the most trying condition, both for patient and doctor. The number of remedies recommended for it shows that none of them is really satisfactory in all cases. To mention some: hot fomentations of course, and incision; ointments, paints, vaccines and auto-vaccines; yeast, vitamin A, tin salts, particularly stannoxyl, and lately the sulfonamides and penicillin. Ultra-violet, infra-red and even X-rays have been called to help. Autohaemo-therapy and autosero-therapy also belong to this incomplete list, and so does the vast number of preparations for parenteral protein shock therapy, beginning with milk.

There can be no doubt that all these therapeutic agents are useful. Local treatment combined with general medication is usually efficient, and, after all, even the most refractory hordeolosis yields eventually to a well directed therapy. But frequently it is taking up much time, it may even incapacitate the patient as in protein shock therapy, the preparation of auto-vaccines is a long, expensive procedure, and sulfonamides are potent but toxic drugs.

This is the reason why autohaemo-therapy seems to be highly recommendable. It is easily applied, keeps the patient on his job and is easily available. As to the results it is felt that they are as good as any—if not better. I have used autohaemo-therapy on a great number of unselected cases. If a patient tells me that he feels his third or fourth stye coming up he receives invariably an intramuscular injection of 10 c.c. of his own blood—and it is very rarely necessary to repeat this after a week or two. I had occasion to observe many of the patients thus treated over a long period and could satisfy myself that the cure was a definite one.

A few case histories shall illustrate this:

(1) Cpl. W., aged 28 years, was an orderly in my hospital who reported sick in March, 1946, stating that he had suffered from styes for the last 5 months, that he actually was never without at least one or two during this time. He had received treatment on the usual lines by my predecessor which relieved the discomfort at the time and made the styes clear up quickly, but they kept recurring.

On examination he presented a mild chronic squamous blepharitis and one discharging as well as two young styes. He felt run down and listless but was otherwise healthy.

One injection of 10 c.c. of venous blood was made into the muscles of the thigh and the patient was instructed to stop all local treatment except hot fomentations. Two days later he reported back. The styes were going down and he felt subjectively better. A week later he reported again with a small stye on one lid just beginning. A second injection of 10 c.c. was made, the stye did not develop but became resorbed and from then on—he was observed for 6 more months—he had no further trouble. After the first injection he volunteered the information—brought forward hesitatingly and diffidently—that he felt physically better than ever before and that he was sure it was no imagination.

(2) Pt. T., aged 22 years. Reported with recurrent styes which had almost incapacitated him for the past 4 months. He had received routine treatment from the Medical Officer in his unit. On examination he presented one stye in the right upper lid which closed the eye and made it impossible for him to do his work. He received one injection of 10 c.c. of his own blood, and was told to stop local treatment except hot fomentations.

He reported back after one week. The stye had disappeared and he felt well. He was seen again after one month when no further styes had developed, and he wrote, after having been posted away, 5 months later that he had not had any more trouble with his eyes.

This list could be extended but would become monotonous. It may suffice to say that autohaemo-therapy has been used for many years, that all cases responded most satisfactorily, and that only rarely more than one injection had to be given.

It is not the purpose of this communication to speculate about the biological mechanism of this therapeutic procedure. It seems correct to assume that the blood, taken from the vein and injected into the muscle of the patient, has the properties of foreign blood perfectly adapted to the biological equilibrium of the receptor organism. It leads to a desensitization through stimulation of the reticulo-endothelial system. It is conceivable that specific antibodies are formed.

All this can, of course, be provoked by any protein shock therapy.

It is emphasized, however, that auto-haemotherapy seems to be simpler, cheaper, less brutal and all the same equally effective as more elaborate procedures.

ANNOTATION

Medical Imposition

Devoted Austenians will remember among many felicitous sentences in her works, that in *Mansfield Park*, where it is stated that Lady Bertram was the happiest subject in the world for a little medical imposition. This leads one to offer some remarks on a very threadbare subject, *viz.*, how far it is expedient to tell the whole truth to our patients. ?

A great deal depends on the type of patient and what is the matter with the eyes. A nervous sensitive patient of middle age, with a speck or two in her lenses and with full visual acuity, need not be told that she has incipient cataract. Should she mention the possibility of cataract developing we should explain that, while it is technically correct to say that she has some signs pointing that way, it will probably be many years before any serious diminution of vision will happen. One needs to be explicit over glaucoma cases, possible growths, and wounds of the eye. In the last case the sufferer will be well aware that all is not well with his eye; but an early glaucoma case with good vision and field will need careful handling. It is quite essential to get such a case to understand that the eye is in a bad way and it would be most improper to inculcate anything approaching a *laissez faire* attitude. Each surgeon must make up his own mind in each case. No explicit rules can be laid down for his guidance; but in general it may be stated that there are occasions where a little " imposition " may be not only desirable, but also permissible. We recall the case of a middle aged lady with some lenticular opacities and full vision, to whom we did not mention the word cataract. About a year later she called on us again and asked if, at her last visit, we had noted anything amiss with her eyes, as she had in the interval consulted someone else who told her she had cataract, and expressed surprise that no one had told her of it. Her vision was still 6/6 and we said it was our opinion that the word cataract should not be mentioned in cases such as her's where no diminution of vision was noticeable. Some people ask to be told the whole truth, and occasionally others will implore us not to frighten them.

It is also well known that patients do not always tell us the whole truth in their histories, and one sometimes meets with a case, more likely in hospital than in private practice, where the results of an eye injury bear no comparison with the trivial cause narrated by the patient. Such a case was a young man who ascribed a ruptured globe with no perception of light to having fallen on the pavement and knocked his eye on the kerb stone. Some months later we met him in prison; but hasten to add that our own presence there was not due to any summary conviction, but purely to the fact that we were asked to go and help a friend, who was the assistant M.O., to provide half-a-dozen old lags with glasses to enable them to see to do their official tasks.

BOOK NOTICE

Diseases of the Retina. By HERMAN ELWYN. Pp. 587 and xl, 170 illustrations, 19 in colour. London: J. and A. Churchill. 1946. Price, 45/-

It is well recognised that many bodily ailments have characteristic manifestations visible by ophthalmoscopy, and the diagnosis of serious constitutional disease is not uncommonly made first, and frequently quite correctly, by the oculist. The author states in his preface that he has aimed at a complete and systematic presentation of the diseases which affect the retina in order to supply the needs of students and practitioners, presumably both of medicine and ophthalmology; to this extent the book is a compromise with some of the inherent disadvantages which such must entail. From the ophthalmologist's viewpoint, it may be questioned if it is advisable or desirable when dealing with an organ whose parts are so closely integrated as the eye, to devote a book of this length to diseases of the retina alone with little and only passing reference to the oecology of the organ as a whole.

As a compromise, however, it must be regarded as eminently successful. The first part is devoted to a consideration of retinal diseases resulting from disturbances of circulation interpreted widely and including blood diseases, diabetes, and certain other conditions such as disseminated lupus erythematosus. Subsequent parts deal with retinal vascular malformations; degenerative diseases on a hereditary basis; inflammatory diseases of the retina (a section in which one may feel that undue emphasis is laid on tuberculosis); retinal tumours; diseases leading to retinal "detachment"; developmental anomalies including macular colobomata, melanosis retinae,

and congenital retinal folds; and finally, radiational injuries from intense light and from lightning. Contrary to generally accepted teaching, it is suggested that some part of the short wave emission may reach and be responsible for damage to the retina.

Since it describes or mentions the fundus changes which have been observed in a whole host of general medical conditions, this book will be welcome to the ophthalmologist. A valuable, but by no means comprehensive bibliography is appended to the section on each disease discussed; through this it is possible to follow up aspects which one may consider too briefly described, such as genetics in the sections on hereditary defects and the pathology of many conditions.

To the general physician too, this book should be useful, and altogether it may be warmly welcomed as a painstaking and carefully thought out contribution to that ever widening field wherein ophthalmology and general medicine are recognised to overlap.

CORRESPONDENCE

POST-OPERATIVE SECURITY IN CATARACT CASES

To the Editors of THE BRITISH JOURNAL OF OPHTHALMOLOGY.

DEAR SIRS,—The paper by Mr. T. G. Wynne Parry on "Post-operative Security in Cataract Cases" (*Brit. Jl. Ophthal.*, September, 1947) is of unusual interest. Dealing with ignorant unco-operative native patients one is never surprised to see the morning's cataract case sitting outside in the afternoon sun, so any method which offers added security in the closure of the corneal wound will attract attention. But surely the shutting off from view of the periphery of the anterior chamber for four or five days or perhaps longer is a disadvantage? A small hyphaema may be absorbed in that time, a point of significance if this complication is to be treated statistically; also an early hypopyon may be missed and time lost before resorting to subconjunctival penicillin.

Relying on rapid sealing of the conjunctiva to the sclera I have for some time been using a subconjunctival approach (*East Afr. Med. Jl.*, May, 1946). Briefly, an horizontal incision less than the width of the cornea is made in the conjunctiva some 5 mm. above the limbus, and through this the conjunctiva is undermined all round the upper half of the cornea, the separation being no more than will allow the blade of a scissors to pass easily. Worth's

muscle forceps is then placed on the limbus at right angles to the 12 o'clock meridian with one blade superficial and the other deep to the conjunctiva. When locked this forceps gives excellent fixation and a keratome can be passed beneath the blades without the globe rotating, or the anterior chamber can be opened with a B.P. No. 15 knife "ab externo." The rest of the operation is on established lines for the "keratome-scissors" section except that the outer blade of the scissors is passed beneath the conjunctiva. I usually place a mattress suture in the conjunctiva before making the corneal section; when tied it puts a certain amount of tension on the conjunctiva and so helps to keep the edges of the corneal wound in apposition.

I believe that the protective cushioning effect of the intact conjunctiva over the corneal wound prevents painful stimuli which must otherwise occur as the eye turns and the wound edges are rubbed by the lid. Certainly patients seem more comfortable than with the Stallard-Liégard corneal suture. As the section is more "limbic" than "corneal," the ultimate result is an invisible scar.

I am, Yours faithfully,

A. J. BOASE.

MULAGO HOSPITAL,
KAMPALA, UGANDA.
October 20, 1947.

NOTES

Ophthalmic Literature

A SLIP insertion in the August and September issues of the Journal drew attention to the subscription for "Ophthalmic Literature" which starts on January 1, 1948. It is £3 3s. per annum, and, if included in the annual subscription to the *British Journal of Ophthalmology*, the total is £5 5s.

We understand from the manager that though orders have come in regularly since the proposal was announced the response on the whole has not been quite up to expectation. The Journal cannot make a present of "Ophthalmic Literature" to its subscribers as Monograph Supplements have been supplied in the past. The former is a regular quarterly production, the latter appear at sporadic intervals and rarely more often than once a year.

There is always a strong chance that a slip insertion may be put on one side, mislaid or forgotten. In such cases re-iteration sometimes bears fruit. We should not like to think that our subscribers were actuated by sentiments similar to those of the Friend of Humanity in Canning's "Needy Knife-grinder":—"I give thee sixpence! I will see thee damn'd first."

* * * *

The Leslie Dana Gold Medal

THE Leslie Dana Gold Medal, awarded annually for outstanding achievements in the prevention of blindness and the conservation of vision, for the current year has been awarded to Dr. Frederick H. Verhoeff, of Boston, Mass.

* * * *

Royal Society of Medicine, Section of Ophthalmology Officers and Council for Session 1947-48

President, Harold Levy; *Immediate Past-President*, P. E. H. Adams; *Vice-Presidents*, Sir Stewart Duke-Elder, K.C.V.O., F. W. Law, Air Commodore P. C. Livingston, C.B.E., A. B. Nutt, J. D. Magor Cardell, Charles Goulden, O.B.E., John Marshall, M.C., F. A. Williamson-Noble; *Other Members of Council — Physicians*, Harvey Jackson, Joe Pennybacker, Macdonald Critchley; *Metropolitan Members*, A. J. B. Goldsmith, Mary A. Pugh, B. W. Rycroft, O. B. E., Victor Purvis, Arthur Lister, Hon. G. J. O. Bridgeman, M.C., A. G. Cross, H. E. Hobbs, Philippa P. Martin; *Provincial Members*, Dorothy R. Campbell, J. P. Lloyd, G. T. Willoughby Cashell, G. I. Scott, O. M. Duthie, R. N. B. Cridland; *Representative on Library Committee*, Arnold Sorsby; *Representative on Editorial Committee*, E. Wolff,

Dates reserved for meetings of the Section. Meetings are held at 5 p.m. (Cases at 4.30 p.m.). 1947—December 11. 1948—February 12, March 11, April*, June 10 (Annual). N.B.—Meetings *may* be changed to Fridays at 8.30 p.m. If so, due notice will be given in the Diary Card.

P. M. Moffatt, 115a, Harley Street, W.1, A. Seymour Philps, 104, Harley Street, W.1.—*Honorary Secretaries.*

* * * *

Request from a Swiss Ophthalmic Nurse-Secretary

A YOUNG Swiss lady, 27 years of age, is anxious to visit England in the Spring of 1948 in order to improve her knowledge of English.

*Combined Meeting with O.S.U.K.

She would like to find hospitality, on "au pair" conditions with an English eye-specialist for six months.

After leaving school she worked in a private hospital at Fontainbleau at surgical nursing. For the past ten years she has been with Professor P. Knapp, eye-specialist, of Basle, as assistant and surgical nurse.

If any of our readers can help in this matter please write to Madlle. T. Mahrer, c/o. Professor Paul Knapp, Klingenthalgraben, 31, Basle, Switzerland.

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Welder's Conjunctivitis

WE have received a letter from Dr. Brecher of Bucharest, which owing to paper restrictions, we are unable to reproduce in full. It deals with "welder's conjunctivitis"—the type produced by exposure to an electric arc—he suggests that the disease is toxo-allergic in origin. He found that the symptoms were relieved by bathing the eyes with a solution of sodium thio-sulphate 2 per cent., combined with "chlorate of calcium" 2 per cent. (we take this to be calcium chloride). Whereas with the usual treatment sufferers from this condition were off work for two or three days, by the above method they were able to return to work without any rest period.

Dr. Brecher suggests that his sodium thio-sulphate and calcium chloride lotion would be of use in other toxo-allergic conditions, such as spring catarrh, filamentary keratitis, etc.

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International Organisation Against Trachoma

THE International Organization against Trachoma was founded officially by decision of the XIIIth Concilium Ophthalmologicum at its meeting at Amsterdam in 1929. It provides a society at the meetings of which matters of scientific, therapeutic, and international interest connected with trachoma may be discussed.

The last general assembly of delegates and members was held in London on April 21, 1939. The proceedings were reported in *La Revue Internationale du Trachome* for July, 1939, and in the British Medical Journals.

A meeting of the executive committee of the I.O.A.T. was held in Paris on May 17, 1947, at 66, Boulevard Saint-Michel. There were present: Dr. MacCallan (President); Dr. Wibaut (Secretary-General); Professor Nordensen (President of the Concilium

Ophthalmologicum); Dr. Ehlers (Secretary-General of the Concilium Ophthalmologicum); Dr. Bailliart (Président de l'Association Internationale de Prophylaxie de la Cécité); Dr. Lavery (Eire); and Dr. Churchill (Secretary-General Adjoint de l'Association Internationale de Prophylaxie de la Cécité). The accounts were scrutinized and passed as correct, and it was decided to hold the next general assembly of delegates and members and the scientific meeting in London in 1950.

The quarterly journal, *La Revue Internationale du Trachome*, which is published in French and in English, is the official organ of the I.O.A.T. Publication ceased during the War, but it is hoped to recommence shortly. Articles by members of the I.O.A.T. may be sent to Dr. Jean Sedan, 94, Rue Sylvabelle, Marseille, Secretaire-General de la Ligue contre le Trachome, Editeurs de *La Revue Internationale du Trachome*.

Membership of the I.O.A.T. is by an annual subscription of twenty-five shillings sterling; this may be paid to the account of the I.O.A.T. at the National Provincial Bank, 23, Wigmore Street, London, W.1. Larger donations from ophthalmological societies are invited for the purpose of meeting the general expenses of the organization.

If circumstances permit, *La Revue Internationale du Trachome* will be posted to members as published.

Further information may be obtained from the President, A. F. MacCallan, Westminster Hospital Medical School, 17, Horseferry Road, London, S.W.1., or from the Secretary-General, F. Wibaut, P.C. Hooftstraat, 145, Amsterdam.

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Abstract of the Will of Thomas Masters, Spectacle-Maker

7th December: I Charles. Thomas Masters, Spectacle-maker, of St. Clement Danes without Temple barre, being sicke in bodie but of perfect memorie laud and praise be given to God . . . Soule into the hands of Almightie God my maker and of Jesus Christ . . . my bodie to be buried in decent Christian buriall. After payment of debts and funerall . . . I give unto my sonne Francis Masters all my estate whatsoever whether it be redie money, bills, bonds, specialties, leases or any thing els to be paid to him when he shall accomplish the age of 18 and in the meantime I request my loving brother Edward Masters to have a special care over my said child and see him well brought upp, to whome I committ the custodie and keeping of my said child and if it happen . . . to dye before he accomplish the age of 18, then I give to my brother Twigden Masters 40s. to make him a ringe. Item. I give to my brethren

John and Richard 20s. a peece. Residue to brother Edward, my executor. Witnesses. John Horne, Thomas Fox, Mary Masters. Proved 9, March 1625. (P.C.C. 37, Hele).

King James the First died in 1625. Masters signed his will on Dec. 7 of that year, and it was proved on March 9th, 1625/26 O.S. It is a pity that he does not mention any of the tools of his craft.

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Barnacles, Goggles and Gig Lamps

THESE terms are all slang for spectacles and like many other slang words are quite descriptive. Barnacles appears to be the eldest of the three. The shorter Oxford Dictionary gives the date, 1571 and gives as a probable derivation from the term used for a bit for the mouth of a horse or ass. As the rider bestrides the horse, so the barnacles bestride the nose. Sam Weller made use of the term in alluding to Mr. Ben Allen at Dingley Dell.

Goggle was used in 1688 for a squint, a leer, or a stare. One form of goggles was a form of spectacles, usually with coloured glass, and more rarely of fine wire netting fixed in short tubes to protect the eye from dust: and this form of implement seems to have been used in the treatment of squint. In 1715 spectacles with round glasses were termed goggles; but whether this had any reference to the Old Pretender we do not know.

The use of gig lamps according to the dictionary is comparatively recent, not much earlier than 60 years ago. The idea was derived from the lamps on each side of a gig or dog-cart. Mr. Samuel Pepys, it will be recalled, tried a "tube-spectacall" of paper used with his right eye, and was at first mightily pleased with it. This was in 1668, but the good effects were not lasting. Previously, in 1666, he had bought a pair of green spectacles, but unfortunately for us he does not call them either barnacles or goggles.